



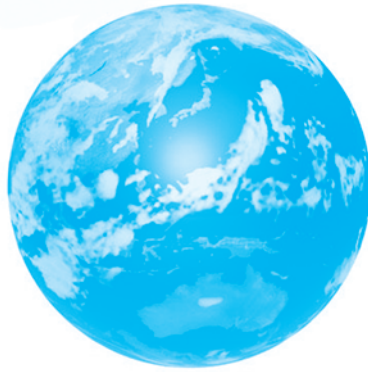
# ENCYCLOPEDIA OF WORLD GEOGRAPHY

R. W. McCOLL, EDITOR





Encyclopedia of  
**WORLD  
GEOGRAPHY**



R.W. McCOLL, PH.D.  
GENERAL EDITOR



Facts On File, Inc.



## Encyclopedia of World Geography

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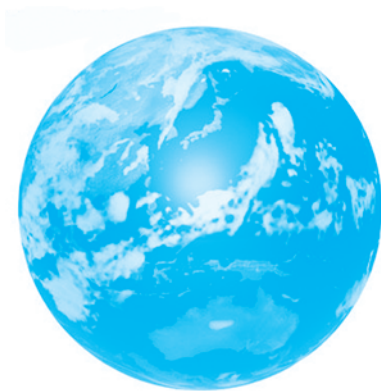
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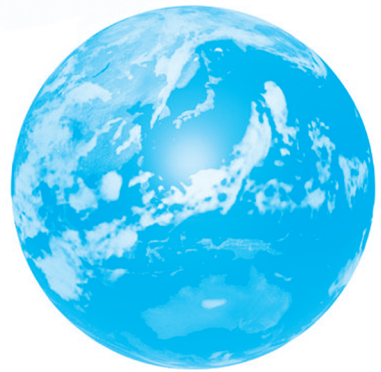
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## Foreword

Editor's Note: Geographers are marked by a desire to explore, see, and understand both places and the relationships between human activities and the natural environment. Alexander von Humboldt (1769–1859) is significant to the study of geography due the breadth of his scientific inquiries and knowledge and his ability to integrate these studies within larger works that were both scientifically advanced and appealing to a wider nonspecialist public. He was known as a natural scientist of the highest order, working to unify studies of botany, zoology, and ecology, but also as a competent writer whose works provided a wide audience with their only glimpse of South America, a continent previously known to most only through myth and speculation. In Humboldt's introduction to *Personal Narrative of a Journey to the Equinoctial Regions of the New Continent*, he describes what the science of geography is all about, how a geographer works, and the rewards found in the study of the science.

TWELVE YEARS HAVE elapsed since I left Europe to explore the interior of the New Continent. From my earliest days I was excited by studying nature, and was sensitive to the wild beauty of a landscape bristling with mountains and covered with forests. I found that traveling out there compensated for a hard and often

agitated life. But pleasure was not the only fruit of my decision to contribute to the progress of the physical sciences. For a long time I had prepared my self for the observations that were the main object of my journey to the torrid zone. I was equipped with instruments that were easy and convenient to use, made by the ablest artists, and I enjoyed the protection of a government that, far from blocking my way, constantly honored me with its confidence. I was supported by a brave and learned friend whose keenness and equanimity never let me down, despite the dangers and exhaustion we faced.

Under such favorable circumstances, and crossing regions long unknown to most European nations, including Spain itself, Bonpland [Humboldt's companion] and I collected a considerable number of materials, which when published may throw light on the history of nations, and on our knowledge about nature. Our research developed in so many unpredictable directions that we could not include everything in the form of a travel journal, and have therefore placed our observations in a series of separate works.

Two main aims guided my travels ... I wanted to make known the countries I visited, and to collect those facts that helped elucidate the new science vaguely named the Natural History of the World, Theory of the Earth, or Physical Geography. Of these two aims, the second seemed the more important. I was

passionately keen on botany and certain aspects of zoology, and flattered myself that our researches might add some new species to those already known. However, rather than discovering new, isolated facts, I preferred linking already known ones together. The discovery of a new genus seemed to me far less interesting than an observation on the geographical relations of plants, or the migration of social plants, and the heights that different plants reach on the peaks of the cordilleras.

The natural sciences are connected by the same ties that link all natural phenomena together. The classification of species, which we should consider as fundamental to botany, and whose study has been facilitated by introducing natural methods, is to plant geography what descriptive mineralogy is to the rocks that form the outer crust of the earth. To understand the laws observed in the rocks, and to determine the age of successive formations and identify them from the most distant regions, a geologist should know the simple fossils that make up the mass of mountains. The same goes for the natural history that deals with how plants are related to each other, and with the soil and air. The advancement of plant geography depends greatly on descriptive botany; it would hinder the advancement of the sciences to postulate general ideas by neglecting particular facts.

Such considerations have guided my researches, and were always present in my mind as I prepared for the journey. When I began to read the many travel books ... I regretted that previous learned travelers seldom possessed a wide enough knowledge to avail themselves of what they saw. It seemed to me that what had been obtained had not kept up with the immense progress of several sciences in the late 18th century, especially geology, the history and modifications of the atmosphere, and the physiology of plants and animals. Despite new and accurate instruments, I was disappointed, and most scientists would agree with me that while the number of precise instruments multiplied, we were still ignorant of the height of so many mountains and plains; of the periodical oscillations of the aerial oceans; the limit of perpetual snow under the polar caps and on the borders of the torrid zones; the variable intensity of magnetic forces; and many equally important phenomena.

Maritime expeditions and voyages round the world have rightly conferred fame on naturalists and astronomers appointed by their governments, but while these distinguished men have given precise notions of the coasts of countries, of the natural history of the

ocean and islands, their expeditions have advanced neither geology nor general physics as travels into the interior of a continent should have. Interest in the natural sciences has trailed behind geography and nautical astronomy. During long sea voyages, a traveler hardly ever sees land; and when land is seen after a long wait, it is often stripped of its most beautiful products. Sometimes, beyond a sterile coast, a ridge of high mountains covered in forests is glimpsed, but its distance only frustrates the traveler.

Land journeys are made very tiresome by having to transport instruments and collections, but these difficulties are compensated by real advantages. It is not by sailing along a coast that the direction, geology, and climate of a chain of mountains can be discovered. The wider a continent is, the greater the range of its soil and the richness of its animal and vegetable products, and the further the central chain of mountains lies from the ocean coast, the greater the variety of stony strata that can be seen, which reveal the history of the earth. Just as every individual can be seen as particular, so we can recognize individuality in the arrangement of brute matter in rocks, in the distribution and relationships of plants and animals. The great problem of the physical description of the planet is how to determine the laws that relate the phenomena of life with inanimate nature.

In trying to explain the motives that led me to travel into the interior of a continent, I can only outline what my ideas were at an age when we don't have a fair estimate of our faculties. What I had planned in my youth has not been completely carried out. I did not travel as far as I had intended when I sailed for South America; nor did it give me the number of results I expected. The Madrid Court had given me permission in 1799 to sail on the *Acapulco* galleon and visit the Philippine Islands after crossing its New World colonies. I had hoped to return to Europe across Asia, the Persian Gulf, and Baghdad.

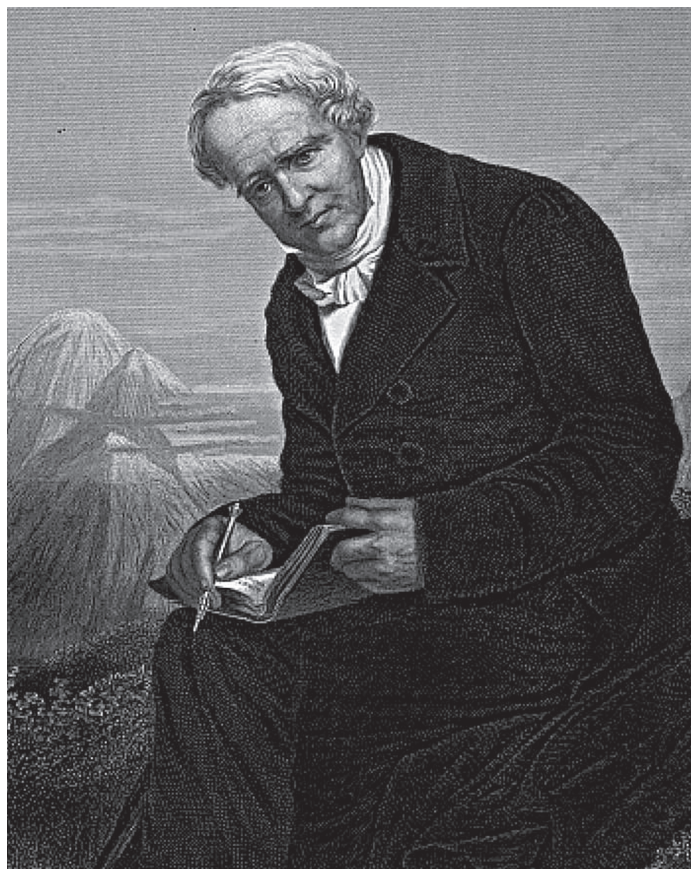
Having outlined the general aim, I will now briefly glance at the collections and observations we made. The maritime war during our stay in America made communications with Europe very uncertain and, in order for us to avoid losses, forced us to mail three different collections. The first we sent to Spain and France, the second to the United States and England, and the third, the most considerable, remained constantly with us. Toward the end of our journey, this last collection formed 42 boxes containing a herbal of 6,000 equinoctial plants, seeds, shells, and insects, and geological specimens from Chimborazo, New Granada

and the banks of the Amazon, never seen in Europe before. After our journey up the Orinoco, we left a part of this collection in Cuba in order to pick it up on our return from Peru and Mexico. The rest followed us for five years along the Andes chain, across New Spain, from the Pacific shores to the West Indian seas. The carrying of these objects, and the minute care they required, created unbelievable difficulties, quite unknown in the wildest parts of Europe.

Our progress was often held up by having to drag after us for five and six months at a time from 12 to 20 loaded mules, change these mules every eight to 10 days, and oversee the Indians employed on these caravans. Often, to add new geological specimens to our collections, we had to throw away others collected long before. Such sacrifices were no less painful than what we lost through accidents. We learned too late that the warm humidity and the frequent falls of our mules prevented us from preserving our hastily prepared animal skins and the fish and reptiles in alcohol. I note these banal details to show that we had no means of bringing back many of the objects of zoological and comparative anatomical interest whose descriptions and drawings we have published. Despite these obstacles, and the expenses entailed, I was pleased that I had decided before leaving to send duplicates of all we collected to Europe. It is worth repeating that in seas infested with pirates, a traveler can only be sure of what he takes with him. Only a few duplicates that we sent from America were saved; most fell into the hands of people ignorant of the sciences. When a ship is held in a foreign port, boxes containing dried plants or stones are merely forgotten, and not sent on as indicated to scientific men.

The same reasons that slowed our communications also delayed the publication of our work, which has to be accompanied by a number of engravings and maps. If such difficulties are met when governments are paying, how much more worse they are when paid by private individuals. It would have been impossible to overcome these difficulties if the enthusiasm of the editors had not been matched by public reaction.

In our publications, Bonpland and I have considered every phenomenon under different aspects, and classed our observations according to the relations they have with one another. To convey an idea of the method followed, I will outline what we used in order to describe the volcanoes of Antisana and Pichincha, as well as Jorullo, which of the night of the 20th of September 1759 rose 1,578 feet up from the plains of Mexico. We fixed the position of these remarkable



*Alexander von Humboldt was known as a preeminent geographer and a scientist of the highest order.*

mountains in longitude and latitude by astronomical observations. We took the height of different parts with a barometer, and determined the dip of the needle and magnetic forces. We collected plants that grew on the slopes of these volcanoes, and specimens of different rocks. We found out the exact height above sea level at which we made each collection. We noted down the humidity, the temperature, the electricity and the transparency of the air on the brinks of Pichincha and Jorullo; we drew the topographical plans of these volcanoes by measuring vertical bases and altitude angles. In order to judge the correctness of our calculations, we have preserved all the details of our field notes.

During my navigation up the South American rivers and over land, I had written a very brief itinerary where I described on the spot what I saw when I climbed the summit of a volcano or any other mountain, but I did not continue my notes in the towns, or when busy with something else. When I did take notes, my only motive was to preserve those fugitive ideas



that occur to a naturalist, to make a temporary collections of facts and first impressions. But I did not think at the time that these jotted-down notes would form the basis of a work offered to the public. I thought that my journey might add something to science, but would not include those colorful details that are the main interest in journeys. Since my return, the difficulties I experienced trying to write a number of treatises and make certain phenomena known have overcome my reluctance to write the narrative of my journey. I fear that for many years no foreign traveler will be able to

cross those countries I visited. I also venture to hope, once peace has been established, that my work may contribute to a new social order. If some of these pages are rescued from oblivion, those who live on the banks of the Orinoco or Atabapo may see cities enriched by commerce and fertile lands cultivated by free men on the very spot where during my travels I saw impenetrable jungle and flooded lands.

ALEXANDER VON HUMBOLDT  
PARIS, FEBRUARY 1812

## Introduction

GEOGRAPHY'S primary focus is “where?” This question has been an essential part of human history from its outset. Knowing where there was water, food, safety, where were the cities and best trade products and special raw materials, especially flint and later metal for tools, was crucial to human and cultural evolution. The need as well as the desire (curiosity) to explore new places and experiences would seem an ingrained human characteristic. Certainly, the ability to predict seasonal cycles for migration and foods—simple survival—elevated those who knew the answers to special, probably shamanistic or priestly, positions.

There is little in this world that is not geographic in some way. Anything that has a place, any place that has an impact on human history, or any human activity is geographic. Once the geographer knows where things are, the analytical focus becomes one of how humans and place are related or interact. For example, how do desert people adapt? How do they conserve and use water? How and when do they move? What kinds of shelter have they evolved?

Geography is one of those subjects essential to understanding virtually everything; yet as we witness in the daily news of events around the world, it is studied and understood by few policy makers and politicians or even journalists. Geography is a subject that encom-

passes all the topics necessary for the Renaissance person: familiarity with the natural environment, society, and knowledge of cultures, distant and near places, economics, politics, physics, the atmosphere, the literature of places and cultures as it reflects its environment, as well as the mapping and measuring of spatial distributions and relationships.

There was a time when geographers necessarily focused on collecting and inventorying facts and data about places because much of the world was unknown. This basic need has not generally passed. Even in the 21st century an inventory of the location and nature of places, peoples, economies, species, and so on, remains essential, especially given the high rate of change. Fortunately we have satellite images that reveal not only what is there but how it is changing and the rate of change, both natural and human caused.

Once they have a basic inventory of the planet, geographers can begin to focus on human and environmental relations and the interactions between geography and politics, economics, and warfare. In the past, the geographic inventory sometimes was used for military purposes. Other times it was used for trade and economics. In the past, maps were so valuable they became closely held state secrets. Today, the widespread availability of geographic data on the internet and the use of global positioning satellites (GPS) and geographic information systems (GIS) have even led



some to use latitude and longitude as their personal address. Travelers increasingly find GPS locations on signs in yacht harbors or desert road race landmarks. Computer mapping and satellite images have moved from the realm of military intelligence and the battlefield to applications in real estate and businesses as well as disease control, disaster monitoring and relief, and even hunting and fishing. Many large farmers in the U.S. Midwest now have GPS and GIS on their combines and tractors and use them to further increase their efficiency and productivity.

As the world has become more integrated via television, air travel and now the internet, knowledge of different places and cultures has likewise increased in value and necessity. Today, one may talk to a technician in India about a computer problem in the United States. Banks and institutions move money around the world in milliseconds. Tourists withdraw money from their local banks at bank machines all over the world. Cell phones are used by Mongol herdsmen in the middle of the Gobi to call relatives in Miami. Masai herdsmen in Kenya watch satellite television from around the world. Al Qaeda agents meet in Iguazu Falls to avoid Interpol and American security. Cell phones with cameras can be used to call home from virtually anyplace on the planet and may even send photos of people as well as places.

Most are familiar with the observation that those who ignore history are doomed to relive it, but we can add that those who ignore geography (distances, map projections, cultural distinctions, seasons, etc.) are doomed to face unnecessary difficulties and problems—personal, economic, and political. Certainly the economic and political events of the early 21st century continue to evidence this.

Geography and geographers are at the center of one of the newest and fastest growing industries in the world. The need to know where anything is—crime, raw materials, the enemy, political groups or voters—and then the total geographic context (when does a crime occur, what is the access to a raw material, what are the supply lines and disposition of an enemy, how have the voters voted and what are their ages, sex, ethnicity, etc.) is limitless. City planners need to know

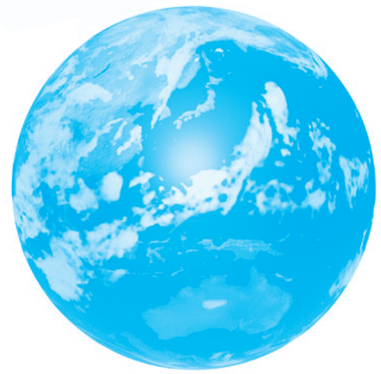
where property lines, soil types, tax status zones, and utilities lines (both above and below ground) are to provide a range of services from schools and hospitals to police and fire rescue. Military uses of digital maps and GPS to send planes, missiles, and covert units to specific houses—even windows and doors—are seen on nightly television in both the real world and various forms of entertainment.

People ignorant of world places, distances, cultures, and religions continue to create unnecessary problems. It is our hope that this encyclopedia may help fill the gap. To that end we have included some 750 articles that describe places, concepts, theories, people, and themes in world geography. From the Fulda Gap to the Hudson River, just about all countries, territories, and land masses are profiled. Icon maps and some 200 graphics, maps, and photos complement the text. In addition, a complete world atlas is presented in an appendix. It is this thorough accumulation and carefully edited information that comprises the encyclopedia.

This encyclopedia and its various parts provide both a basic geographic definition and context for the most modern applications of geography to geopolitical aspects and geographic facts related to ancient as well as modern history. To avoid a purely European or American view, we have sought and included contributors from all areas of the world.

You can use this work to find out about places familiar and exotic. There are basic (traditional) definitions and facts. But, more important, you can also find explanations of historical context and politics as well as the terms and ideas of modern technology. For students, it is important to recognize that geography can be used to study the distant past, from the age of dinosaurs to the earliest humans and the earliest civilizations. Geography also is highly relevant to our world of multinationals, global terrorism, and geopolitics.

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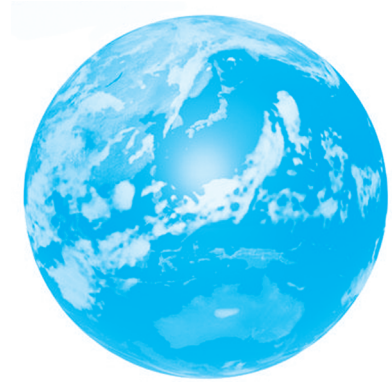
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Belarus  
Belgium  
Belize  
Benares  
Benelux  
Benguela Current  
Benin  
Bermuda  
Bhutan

- |                                       |                               |                       |
|---------------------------------------|-------------------------------|-----------------------|
| Bight of Benin                        | choke point                   | determinism           |
| biome                                 | Christaller, Walter           | Dhaka                 |
| bioreserve                            | Christmas Island              | diffusion             |
| biosphere                             | city-states                   | direction             |
| Black Sea                             | city types                    | distance              |
| Bokkara                               | civilizations, early river    | Djibouti              |
| Bolivia                               | climate                       | Dominica              |
| Bordeaux                              | climate classifications       | Dominican Republic    |
| Borneo                                | coastal zone                  | domino theory         |
| Bosnia and Herzegovina                | Cocos (Keeling) Islands       | Don River             |
| Botswana                              | Colombia                      | Drakensburg Mountains |
| boundaries, natural                   | colonialism                   | dunes                 |
| boundaries, political                 | Colorado                      |                       |
| Bouvet Island                         | commercial agriculture        | E                     |
| Brazil                                | Comoros                       | earthquake            |
| British East India                    | computer mapping              | East Timor            |
| British Empire                        | Congo                         | Easter Island         |
| British Indian Ocean Territory        | Congo, Democratic Republic of | ecological niches     |
| Brunei                                | Congo River                   | ecology               |
| Buenos Aires                          | Connecticut                   | economic geography    |
| Bulgaria                              | containment                   | ecosystem             |
| Burkina Faso                          | continental drift             | ECOWAS                |
| Burundi                               | continental shelf             | Ecuador               |
|                                       | continentality                | Egypt                 |
| C                                     | continents                    | El Niño and La Niña   |
| California                            | Cook Islands                  | El Salvador           |
| Cambodia                              | core and periphery            | Elbrus, Mount         |
| Cameroon                              | Costa Rica                    | Elburz Mountains      |
| Canada                                | Côte d'Ivoire                 | electoral geography   |
| Canadian Shield                       | Croatia                       | elevation             |
| Canary Islands                        | Cuba                          | enclave               |
| canyon                                | cultural geography            | energy geography      |
| Cape Verde                            | cyclones                      | entrepot              |
| capitals                              | Cyprus                        | epidemiology          |
| Caribbean Sea                         | Czech Republic                | Equatorial Guinea     |
| cartogram                             |                               | erg                   |
| cartography                           | D                             | Erie, Lake            |
| Caspian Sea                           | Damascus                      | Eritrea               |
| Catholic Church                       | Danube River                  | erosion               |
| Caucasus Mountains                    | Danubian Gates                | escarpment            |
| Cayman Islands                        | Darien Gap                    | esker                 |
| Central African Republic              | Davis, William M.             | Estonia               |
| Central American Free Trade Agreement | Dead Sea                      | Ethiopia              |
| central business district             | Deccan Plateau                | Ethiopian Highlands   |
| Chad                                  | Delaware                      | European Union        |
| Chad, Lake                            | Delmarva Peninsula            | Everest, Mount        |
| Changjiang (Yangzi River)             | delta                         | exotic rivers         |
| Chechnya                              | demographics                  |                       |
| Chile                                 | Denmark                       | F                     |
| China                                 | desert                        | facilities mapping    |
|                                       | desertification               | Falkland Islands      |

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- |                               |                                 |                         |
|-------------------------------|---------------------------------|-------------------------|
| Faroe Islands                 | Guadeloupe                      | Industrial Revolution   |
| Fayum                         | Guam                            | insurgent state         |
| federation                    | Guatemala                       | intercropping           |
| Fertile Crescent              | guerrilla bases                 | international date line |
| Fiji                          | Guinea                          | Intifada                |
| Finland                       | Guinea-Bissau                   | Iowa                    |
| floodplain                    | Gulf of Aqaba                   | Iran                    |
| floods                        | gulf stream                     | Iraq                    |
| Florida                       | Guyana                          | Ireland                 |
| footloose industries          |                                 | irrigation              |
| forests                       | H                               | Irrawaddy River         |
| fractal geography             | Hainan Island                   | Islam                   |
| France                        | Haiti                           | island                  |
| French Guiana                 | hammada                         | Isphahan                |
| French Polynesia              | Hawaii                          | Israel                  |
| French Southern Territories   | Heard and McDonald Islands      | Istanbul                |
| frontier                      | heartland                       | Italy                   |
| Fulda Gap                     | hemisphere                      |                         |
|                               | Himalayas                       | J                       |
| G                             | Hindu Kush                      | Jakarta                 |
| Gabon                         | hinterland                      | Jakota Triangle         |
| Gaia                          | historical geography            | Jamaica                 |
| gallery (galeria) forests     | Hokkaidô Island                 | Japan                   |
| Gambia                        | homeland security               | Java                    |
| Ganges River                  | Honduras                        | Jerusalem               |
| gender geography              | Hong Kong                       | jet stream              |
| geographic database           | Horn of Africa                  | Jordan                  |
| geographic information system | horst                           | Jordan valley           |
| geomorphology                 | Huang (Yellow) River            | Junggar Basin           |
| geopolitics                   | Hudson River                    |                         |
| Georgia (country)             | human-environment relationships | K                       |
| Georgia (state)               | human geography                 | Kalahari Desert         |
| geostrophic winds             | Humboldt, Alexander von         | Kamchatka Peninsula     |
| Germany                       | Humboldt Current                | Kansas                  |
| Ghana                         | Hungary                         | Karachi                 |
| Gibraltar                     | Huntington, Ellsworth           | karst                   |
| glaciation                    | Hunza                           | Kashmir                 |
| global warming                | Huron, Lake                     | Kazakhstan              |
| globalization                 |                                 | Kentucky                |
| Gobi Desert                   | I                               | Kenya                   |
| Golan Heights                 | Ibn Battuta                     | Khartoum                |
| Grand Canal (China)           | Iceland                         | Kilimanjaro, Mount      |
| Grand Canyon                  | Idaho                           | Kiribati                |
| grasslands                    | Illinois                        | Kola Peninsula          |
| Great Barrier Reef            | immigration                     | Kolkata (Calcutta)      |
| great circle                  | imperialism                     | Kopet Dag               |
| Greece                        | India                           | Korea, North            |
| Greenland                     | Indian Ocean                    | Korea, South            |
| Grenada                       | Indiana                         | Kosciusko, Mount        |
| grid/graticule                | Indonesia                       | Kuroshio Current        |
| growth pole                   | Indus River                     | Kuwait                  |



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|------------------------|--------------------|--------------------------|
| Kyrghiz Steppes        | Mali               | nap of the earth         |
| Kyrgyzstan             | Malta              | nationalism              |
| Kyushu Mountains       | Manila             | Nauru                    |
| L                      | maps and globes    | nautical mile            |
| lacustrine plain       | market geography   | Nebraska                 |
| land bridge            | Marshall Islands   | needs and wants          |
| landlocked             | Martinique         | Negev Desert             |
| Laos                   | Maryland           | Nepal                    |
| latitude and longitude | Massachusetts      | Netherlands              |
| Latvia                 | Mauritania         | Netherlands Antilles     |
| Law of the Sea         | Mauritius          | Nevada                   |
| Lebanon                | McKinley, Mount    | New Caledonia            |
| leeward and windward   | Mediterranean Sea  | New Delhi                |
| Lena River             | megaliths          | New Hampshire            |
| Lesotho                | Mekong River       | New Jersey               |
| Lewis and Clark        | Melanesia          | New Mexico               |
| Liberia                | Mercator, Gerardus | New York                 |
| Libya                  | MERCOSUR           | New York City            |
| Liechtenstein          | metric system      | New Zealand              |
| Lisbon                 | Mexico             | Newton, Isaac            |
| Lithuania              | Mexico City        | Ngorongoro Crater        |
| littoral               | Michigan           | Nicaragua                |
| llanos                 | Michigan, Lake     | Niger                    |
| loess                  | microclimates      | Niger River              |
| London                 | Micronesia         | Nigeria                  |
| Loire River            | Mid-Atlantic Ridge | Nile River               |
| Lop Nor                | Middle East        | Niue                     |
| Los Angeles            | migration          | Norfolk Island           |
| Louisiana              | military geography | North American Free      |
| Louisiana Purchase     | Mindanao           | Trade Agreement          |
| Luxembourg             | minerals           | North Atlantic Treaty    |
| Luxor                  | Minnesota          | Organization             |
| Luzon                  | Mississippi        | North Carolina           |
| M                      | Mississippi River  | North Dakota             |
| Macau                  | Missouri           | North Slope              |
| Macedonia (FYROM)      | Moldova            | Northern Mariana Islands |
| Mackenzie-Peace River  | Monaco             | Norway                   |
| Mackinder, Halford J.  | Mongolia           | Nubia                    |
| Madagascar             | monsoon            | O                        |
| Madrid                 | Montana            | Ob-Irtysh River          |
| Magellan, Ferdinand    | Montserrat         | Ohio                     |
| Maghreb                | Morocco            | Okavango                 |
| Magna Graecia          | Moscow             | Oklahoma                 |
| Maine                  | Mosquito Coast     | Olduvai Gorge            |
| Malacca Strait         | Mozambique         | Oman                     |
| Malawi                 | Mozambique Channel | Ontario, Lake            |
| Malawi, Lake           | Mumbai (Bombay)    | Oregon                   |
| Malaysia               | Myanmar (Burma)    | orogeny                  |
| Maldives Islands       | N                  | orographic precipitation |
|                        | Namibia            | Ottoman Empire           |

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- P  
 Pacific Ocean  
 Pakistan  
 Palau  
 Pamir Knot  
 pampas  
 Panama  
 Panama Canal  
 Pannonian Plain  
 Pantanal  
 Papua New Guinea  
 Paraguay  
 Paris  
 peninsula  
 Pennsylvania  
 Persepolis  
 Persian Empire  
 Persian Gulf  
 Peru  
 Petra  
 Philippines  
 Phoenecia  
 physical geography  
 Pitcairn Island  
 place  
 planning  
 plate tectonics  
 plateau  
 playa  
 Pleistocene geography  
 Po Valley  
 Poland  
 political geography  
 Polo, Marco  
 Polynesia  
 Portugal  
 prairie  
 precipitation  
 projection, maps  
 Ptolemy  
 Puerto Rico  
 Puncak Jaya  
 Pyrenees
- Q–R  
 Qatar  
 Quaternary geography  
 rainforests  
 Red Sea  
 redistricting  
 region
- regionalism  
 religion  
 resources  
 Rhine River  
 Rhode Island  
 Rhône River  
 rift valley  
 Ring of Fire  
 Rio Grande  
 riparian  
 river  
 Rocky Mountains  
 Romania  
 rotation, Earth axis  
 Rub' Al Khali  
 Ruhr Valley  
 Russian Federation  
 Ruwenzori Mountains  
 Rwanda
- S  
 Sahara Desert  
 Sahel  
 Saint Kitts and Nevis  
 Saint Lucia  
 Saint Petersburg  
 Saint-Pierre and Miquelon  
 Saint Vincent and The Grenadines  
 Sakhalin Island  
 Samarqand  
 Samoa  
 San Marino  
 São Paulo  
 São Tomé and Príncipe  
 Sargasso Sea  
 satellites  
 Saudi Arabia  
 Sauer, Carl O.  
 scale  
 Sea of Azov  
 Sea Peoples  
 seamounts  
 seasons  
 Senegal  
 Seoul  
 Serbia and Montenegro  
 service industries  
 severe weather  
 Seychelles  
 Shanghai  
 shield
- shifting cultivation  
 Siberia  
 Sierra Leone  
 Silk Road  
 Sinai, Mount  
 Sinai Peninsula  
 Singapore  
 Skeleton Coast  
 Slovakia  
 Slovenia  
 Solomon Islands  
 Somalia  
 Sonoran Desert  
 South Africa  
 South Carolina  
 South China Sea  
 South Dakota  
 South Georgia and  
     South Sandwich Islands  
 Southern African Development  
     Community  
 Spain  
 Spanish Empire  
 spatial interaction  
 Sri Lanka  
 St. Helena  
 St. Lawrence River  
 steppe  
 strait  
 Sudan  
 Sumatra  
 sunspots  
 Superior, Lake  
 Suriname  
 surveys, land  
 Svalbard and Jan Mayen  
 Swaziland  
 Sweden  
 Switzerland  
 Syria
- T  
 taiga  
 Taiwan  
 Tajikistan  
 Tanganyika, Lake  
 Tanzania  
 Tarim Basin  
 Tashkent  
 Tehran  
 Tennessee

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|---------------------|-----------------------------|---------------------------------|
| territoriality      | U                           | Volga River                     |
| Texas               | Uganda                      | Von Thünen, Johann Heinrich     |
| Thailand            | Ukraine                     |                                 |
| Thar Desert         | United Arab Emirates        | W                               |
| third world         | United Kingdom              | wadi                            |
| Three Gorges        | United States               | Wallis and Futuna Islands       |
| thunderstorms       | Ural Mountains              | Washington                      |
| Tian Shan           | urban heat island           | weather                         |
| Tibesti Massif      | urban planning              | West Virginia                   |
| Tibetan Plateau     | urbanization                | Western Sahara                  |
| time zones          | Uruguay                     | wetland                         |
| Titicaca, Lake      | U.S. Minor Outlying Islands | wine geography                  |
| Togo                | Utah                        | Winnipeg, Lake                  |
| Tokelau             | Uzbekistan                  | Wisconsin                       |
| Tokyo               |                             | Wyoming                         |
| Tonga               | V                           |                                 |
| tornadoes           | Vanuatu                     | X                               |
| trade routes        | Vatican City                | xerophytes                      |
| transhumance        | vegetation geography        | Xinjiang                        |
| transportation      | vegetation zones            |                                 |
| geography           | Venezuela                   | Y                               |
| Trinidad and Tobago | Vermont                     | Yemen                           |
| Tropic of Cancer    | vernacular housing          | Yenisey-Angara River            |
| Tropic of Capricorn | Victoria, Lake              | Yucatán Peninsula               |
| tsunamis            | Vietnam                     |                                 |
| Tunisia             | Vinson Massif               | Z                               |
| Turkey              | Virgin Islands (British)    | Zagreb                          |
| Turkmenistan        | Virgin Islands (U.S.)       | Zagros Mountains                |
| Turks and Caicos    | Virginia                    | Zambia                          |
| Islands             | virtual geography           | Zimbabwe                        |
| Tuvalu              | volcanoes                   | zones of convergence/divergence |

## Chronology of Geography

200 million B.C.E.

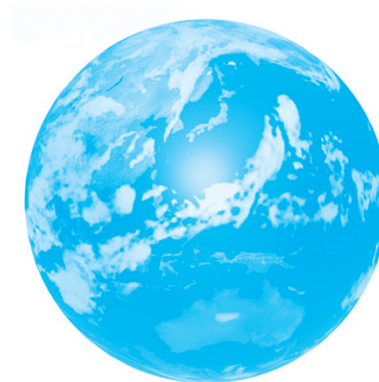
Present-day continents were part of a supercontinent known as Pangaea or Pangea (Greek for “all-Earth”). Over millions of years, this supercontinent broke up through the creation of rifts, cracks in the crust that moved apart and allowed magma to rise from lower levels and form new seabeds. Water moved into the broken landmass to form enclosed bodies of water such as the Gulf of Mexico and the Red Sea. A sufficiently large rift even formed the Atlantic Ocean.

2,000,000 to 18,000 B.C.E.

The last Ice Age was the most recent episode of global cooling of the Earth. Much of the world’s temperate zones were alternately covered by glaciers during cool periods and uncovered during the warmer interglacial periods when the glaciers retreated.

11,000 B.C.E.

Human beings began to domesticate and cultivate plants. This new activity, which eventually changed populations, lifestyles, and the environment in profound ways, proceeded in sporadic bouts. Although the development of agriculture took place over millennia on different continents, its initial beginning is sometimes referred to as the Agricultural Revolution.



3500 B.C.E.

The development of means of transportation, dating from the invention of the wheel, made it possible for the surplus from the countryside to feed urban populations, a system that continues to the present day.

3100 B.C.E.

Egypt appeared as a unified state around 3300 B.C.E. About 3100 B.C.E., Egypt was united under Menes, who inaugurated the 30 pharaonic dynasties in which Egypt ancient history is divided: the Old and the Middle Kingdoms and the New Empire.

2600 B.C.E.

The Indus Valley civilization prospered on the river plains and vicinity in what is western India and Pakistan. The early cities began to interact, creating a common urban culture that lasted about 700 years. The inhabitants were known as the Harappan or Indus culture, and it thrived contemporaneously with those of Mesopotamia and Egypt.

1300 B.C.E.

The recorded history of China dates back some 3,300 years, although modern archaeological studies suggest still more ancient origins in a culture that flourished between 2500 and 2000 B.C.E. Centuries of migration, amalgamation, and development created a distinctive

system of writing, philosophy, art, and political organization that came to be recognized as Chinese civilization.

1120 B.C.E.

Tiglath-Pileser I, the greatest of the Assyrian kings, crossed the Euphrates, defeated the kings of the Hittites, conquered Carchemish, and advanced on the coasts of the Mediterranean. He was the founder of the first Assyrian Empire.

356–323 B.C.E.

Alexander the Great created one of the most extensive empires in history, linking Greece and the Mediterranean to the Indus River and Central Asia.

384–322 B.C.E.

Aristotle hypothesized and scientifically demonstrated that the Earth had a spherical shape. Evidence for this idea came from observations of lunar eclipses.

138 B.C.E.

China's Zhang Qian sought to ally with the Yuezhi tribe in the west and set out on a journey of discovery, resulting in the Silk Road. He returned with no trade ally but with information about horses and tribes hitherto unknown. The emperor sent more expeditions in search of horses and luxuries. Although Zhang Qian is titled as the father of the Silk Road, he was not the first. Even before, Chinese merchants were providing small amounts of Chinese goods to the west via the Silk Road.

150 B.C.E.

From the second half of the 2nd century B.C.E., until the first century, the military campaigns that consolidated the Roman Empire helped the progress of geographic knowledge. The Greeks, as a mainly seafaring people, explored the coast lands; thanks to the Romans, knowledge of the inside lands also became known. The empire extended from England to the Caspian Sea and the Tigris-Euphrates Rivers and included all of North Africa.

150 B.C.E.

Ptolemy was the first to use latitude and longitude and measure them in degrees in his book *Geography*.

313 C.E.

The great advance of Christian expansion was the Constantine Edict in 313. From then on, Christianity

became the official religion of the Roman Empire. This was the start of an alliance between the church and political power that had a great impact on the diffusion of the Christian religion in the ancient world.

400–1300

Middle Ages (5th to 13th centuries) were a time of intellectual stagnation. In Europe, the Vikings of Scandinavia were the only group of people carrying out active exploration of new lands.

In the Middle East, Arab academics began translating the works of Greek and Roman geographers starting in the 8th century and also began exploring southwestern Asia and Africa. Some of the important intellectuals in Arab geography were Al-Idrisi, Ibn Battuta, and Ibn Khaldun.

570

Mohammed heralded the birth of Islam in the area of Mecca and Medina in Saudi Arabia. His influence spread to include all of North Africa, much of Mediterranean Europe, and parts of Central Asia, India, and China.

1100s

Chinese sailing fleets extended their trading missions into the Indian Ocean. Using Calicut in southwestern India as a base, they traveled north following the coast past the Persian Gulf and the southern Arabian Peninsula before heading south to Zanzibar on Africa's east coast.

1100s–1200s

The Crusades involved European kingdoms in the domestic affairs of the Middle East, especially Jerusalem and the Ottoman Empire, centered in the city of Constantinople.

1200s

The century saw the rise of the kingdom of Mali, based upon local gold resources and trade, especially with Arabia. This set the stage for the spread of Islam south of the Sahara.

1206–1350s

The Mongols created an empire that reached from China to Jerusalem and into Southeast Asia.

1300s–1400s

The kingdom and city of Great Zimbabwe reached its height of influence, with Swahili trade along the East

African coast, linking the kingdom to Oman, the Arabian Peninsula, and the coast of India.

### 1325

Born in Tangier, Morocco, Ibn Battuta was a famous Arab traveler and writer who explored in Africa, Europe, and Asia. Ibn Battuta's journey began in North Africa in 1325 with travels that included visits to Egypt, Syria, the Arabian Peninsula (Mecca), (north-eastern) Iran, (southern) Iraq, Red Sea, Yemen, East Africa, Asia Minor, Afghanistan, India, Bengal, Indonesia, China, and Spain. His travels ended in 1353 after a journey across the Sahara and western Africa.

### 1350–1918

The Ottoman Empire had a greater geographic extent than the Roman Empire and emphasized trade and science (navigation, mathematics, astronomy) as well as the arts and medicine. It stretched from the Moors in Spain to India and was ultimately focused on Constantinople in today's Turkey.

### 1400s

From the 15th century on, when ships became the dominant medium for commercial transport, coastal sites, such as Hormuz (Persian Gulf) and Gao (western India), were the main centers for interregional trade for the Indian Ocean. The importance of overland bases returned in the 19th century, however, as new fairs and entrepôts/emporia were established along railroad lines, such as Irkutsk and Vladivostok, which functioned as way stations for the Trans-Siberian Railroad.

### 1421–23

After nearly 400 years of sea trade with ports along the East African coast, Chinese Emperor Zhu Di commissioned Admiral Zheng He to explore and map the world. Recent archaeological findings suggest that Zheng He's great Treasure Fleet circumnavigated the globe, rounding the Cape of Good Hope in Africa and Cape Horn at the tip of South America before returning to China in 1423. It is from this voyage that Niccolò da Conti is believed to have constructed a map later used by Christopher Columbus when he set sail for the East Indies.

### 1400s–1600s

During the Renaissance, numerous journeys of geographical exploration were commissioned by a variety of nation states in Europe. Most of these voyages were financed because of the potential commercial returns

from resource exploitation. The voyages also provided an opportunity for scientific investigation and discovery and added many significant contributions to geographic knowledge. Important explorers of this period include Christopher Columbus, Vasco da Gama, Ferdinand Magellan, Jacques Cartier, Sir Martin Frobisher, Sir Francis Drake, John and Sebastian Cabot, and John Davis. Also during the Renaissance, Martin Behaim created a spherical globe depicting the Earth in its true three-dimensional form in 1492. Prior to Behaim's invention it was commonly believed in the Middle Ages that the Earth was flat. Behaim's globe probably influenced the beliefs of explorers of that time because it suggested that one could travel around the world.

### 1427–1521

The Aztecs created and ruled a major empire centered in what is today's Mexico.

### 1438–1525

The Incas created an empire that organized and ruled much of the Andes Mountains area in South America.

### 1453

With the conquest of the Byzantine capital, Constantinople, under the rule of Mohammed II (1451–81), famously known as “Mehmet the Conqueror,” the Ottomans extended their dominance over much of Anatolia and South Eastern Europe.

### 1492

Italian Christopher Columbus, sailing under a Spanish flag, discovers the New World.

### 1494

Portugal and Spain sign the Treaty of Tordesillas that established the Line of Demarcation. Crossing over present-day Brazil at the approximate longitude of 48 degrees, this meridian line granted to Spain new land to the west and to Portugal the discoveries to the east. Hence, following the landing by Pedro Álvares Cabral at Porto Seguro in 1500, Portugal claimed Brazil.

### 1500s

The 16th century saw the rise of many great kingdoms and empires in Southeast Asia. Many were the precursors of current states or countries.

### 1519

On September 20, 1519, five ships, the *Trinidad*, *San Antonio*, *Concepcion*, *Victoria*, and *Santiago*, along



with a crew of 270 men set sail under Ferdinand Magellan on a journey around the world full of mutiny, discovery, and death.

1530s

In the 1530s, Spanish conquerors subdued the Incas, bringing the Andes Mountains into Spain's New World empire. The Spanish often used systems of forced Native American labor to work in Andean silver mines. The native inhabitants did not always readily accept Spanish rule. In the 18th century, there were more than 100 native rebellions, including the great uprising led by José Gabriel Condorancú in 1780.

1543

The first to proclaim that the Earth and the other planets revolved around the sun was Nicolaus Copernicus, a Polish astronomer who published his theory in 1543, the year of his death. Copernicus also claimed that the Earth rotated on its axis. Additional support for Copernicus came from Johannes Kepler, a German astronomer who rejected Ptolemy's concept of circular revolution and proposed the idea of the elliptical motion of the planets. Finally, it was Galileo Galilei in Italy who demonstrated the accuracy of the Copernican theory.

1564

Gerardus Mercator was appointed court cartographer by Duke Wilhelm of Cleve. During 1564, the map *Angliae Scotiae et Hiberniae nova descriptio* was printed and in 1569 the great map of the world, *Nova et aucta orbis terrae descriptio*, in 18 sheets, was issued to help in navigation. Thanks to this work, Mercator is heralded as the founder of modern cartography.

1587–1621

The Iranian (Persian) city of Isphahan enjoyed its golden age of artistic and architectural achievement, begun under Shah Abbas during the period of the Safavid dynasty, established in Persia in 1502. Mosques, palaces, gardens and bridges were constructed; carpet-making and artistic endeavors were encouraged. Its population swelled to 600,000 and it became one of the great metropolises of the time.

1599

In Asia, chartered companies were trading for spices, textiles, and exotic merchandise like Chinese ceramics. The English East India Company was one of these and obtained a royal charter in 1599.

1603

Edo (as Tokyo was called until 1868) was founded and later became the largest city in Japan, and the largest or second-largest in the world, with a population exceeding one million by the 18th century.

1700s

The 18th century was the start of the industrial and transport revolutions—application of mechanical power to replace animal and human power and labor, leading to the rise of factories, unions, and the development of modern political philosophies.

1773

British naval captain James Cook is the first to cross the Antarctic Circle in 1773. Exploration of the region within the Antarctic Circle resumed in 1820 when the explorer Fabian Gottlieb von Bellingshausen received support from Russian Tzar Alexander I to explore the south polar region.

1788

British territorial acquisition was being consolidated in the South Pacific. Voyages to the Pacific increased British possessions with the discovery of Hawaii, French Polynesia, New Caledonia, New Zealand and the eastern Australian coast. A penal colony was established in New South Wales in 1788.

1792

One of the oldest sources of weather prediction in the United States is the *Old Farmer's Almanac*, an annual publication filled with advice for the self-sufficient. The *Almanac* claims an 80 percent success rate in forecasting the weather—18 months ahead—based on a secret formula devised by *Almanac* founder Robert B. Thomas around 1792.

1800

About 1800, Alexander von Humboldt, a German naturalist, noted the apparent fit of the bulge of eastern South America into the bight of Africa. On the basis of this observation, he theorized that the lands bordering the Atlantic Ocean had once been joined.

1800

Less than 3 percent of the world's population was living in cities of 20,000 or more; this increased to about 25 percent by the mid-1960s and to about 40 percent by 1980. It is estimated that now more than half of the world's population lives in the urban areas, with 90

percent living within 62 mi (100 km) of the coast or a navigable river.

1800

Napoleon's engineers revived the idea and construction of a canal linking the Mediterranean Sea and Indian Ocean (via the Red Sea). The eventual Suez Canal greatly changed maritime trade by reducing the need to go around the Cape of Good Hope at the southern tip of Africa.

1804

Meriwether Lewis and William Clark began an expedition across the newly acquired Louisiana Purchase territory in the United States. For a little over two years, Lewis and Clark led their corps through some 8,000 mi (12,800 km) of unexplored lands, acquiring scientific samples and creating maps.

1826–63

Johan Heinrich von Thünen, an important theorist in the science of land use, publishes his works, bringing together the fields of economics and geography to provide an illustration of the balance between land cost and transportation costs. Although his system was designed to calculate optimal land distribution in preindustrialized Europe—before the development of railroads, for example—the equations and principles he developed remain the foundation of much of land management practices today, particularly in the developing world.

1844

In Germany, Alexander von Humboldt, Carl Ritter, and Friedrich Ratzel made substantial contributions to human and physical geography. Humboldt's publication *Kosmos* (1844) examines the geology and physical geography of the Earth. This work is considered by many academics to be a milestone contribution to geographic scholarship.

1848

Karl Marx and Friedrich Engels publish the *Communist Manifesto*. The relationship between the middle and working classes, and Marx's views on their association, has been greatly influential in wider social and political thought.

1853

U.S. Commodore Matthew C. Perry ended Japan's isolation when he steamed into Tokyo Bay.

1853

A survey drew the boundary between the U.S. state of Texas and Mexico down the middle of the Rio Grande. The first of a series of disputes came in the wake of floods in 1864, which caused a change in the river's course that left a chunk of 630 acres (about 1 square mi or 1.6 square km) of land north of the river. Several other wanderings resulted in losses or gains of land for both countries in the ensuing years.

1855

A French regional wine-rating system was conceived for the Universal Exposition in Paris, when Bordeaux chateaux ("estates") were ranked along a five-tiered system of *crus* ("growths"). These commercially driven designations later extended to other locales, ultimately coexisting with official French labeling requirements and ratings and marking the advent of the discipline of wine geography.

1859

Charles Darwin publishes *Origin of Species* (1859) and suggests that natural selection determined which individuals would pass on their genetic traits to future generations.

1864

One of the earliest statements of environmental ideas came from George Perkins Marsh in his book *Man in Nature or Physical Geography as Modified by Human Action*. This book is often cited by scholars as the first significant academic contribution to conservation and environmentalism.

1880

The desire to find a shortcut from the Atlantic to the Pacific Ocean stretches back at least 500 years. The reality of construction on a canal began in 1880 when Ferdinand de Lesseps, who oversaw construction of the Suez Canal, gained a concession from the Colombian government, which ruled Panama, to begin work on the canal.

1882

The heads of the various railroads met in St. Louis, Missouri, and worked out a system by which they divided the United States into four standard time zones. Each zone would be centered on a meridian of longitude 15 degrees apart—15 degrees multiplied by 24 hour-wide zones producing the full 360-degree circle of the Earth.

1889

Hans Meyer, a German colonial geographer and rich heir of a huge Leipzig publishing house, first ascended Mt. Kilimanjaro's Kibo crater in 1889 and called it Kaiser-Wilhelm-Spitze (since 1962, Uhuru Peak).

1892

New York City's Ellis Island opened to handle the increasingly large volume of immigrants; in 1907 immigration reached its peak of more than 1.2 million people.

1898

Cuba became independent, and Puerto Rico fell under U.S. administration. The Spanish-American War ended 400 years of Spanish dominion in the Americas and marked the rise of the United States as a world power.

1908

In 1908, U.S. scientist Frank B. Taylor invoked the notion of continental collision to explain the formation of some of the world's mountain ranges.

1911

The environmental determinist movement started with the publication of Ellen Churchill Semple's book (*The Influences of the Geographic Environment*), in which she explained how the environment is considered as a major factor in the location of human settlements and economic activity.

1912

William Davis, among the leading geographers of the early part of the 20th century, retired from Harvard University. Today, Davis might be more narrowly considered a geomorphologist based on his major research interests. But in his time, Davis enjoyed considerable influence over the direction and conduct of geographical science in the United States and in Europe.

1914

With the outbreak of World War I, the Ottoman Empire lined up with the Central Powers and faced a humiliating defeat. After World War I ended in 1918, the empire was under the occupation of several Allied powers, including Britain and Greece. It was not until the Kemalist nationalist movement, named after its leader Mustafa Kemal, famously known as Kemal Atatürk (1881–1938), which ended the foreign occupation of Turkey in 1922, that the Ottoman Empire saw its demise. With the creation of Turkey in 1923,

the oldest imperial power in the world was finally abolished and replaced by a secular republic.

1917

British troops took control of Jerusalem and established the British Mandate in Palestine. In 1949, with the end of the British Mandate, Jerusalem was divided into the New City, the capital of the new state of Israel, and the Old City, under Jordanian control. Jerusalem was unified under Israeli control after the Six Day War in 1967. Palestinians hope to see East Jerusalem as the capital of a Palestinian state. As part of the Oslo Accords in 1993, the fate of East Jerusalem was to be resolved by the Israelis and the Palestinians. However, renewed violence in 2000 has prevented such a settlement.

1917

The ecological niche concept is originated as an attempt to describe the general role of species in the community and to differentiate population, community, and ecological systems. The concept and term was introduced by J. Grinnell, who interpreted it in spatial sense as the ultimate distributional unit of a species. Later C. Elton (1927) concentrated mainly on niche functional aspects when describing an organism's place in its biotic environment in connection with its nutrition and other species.

1920s

A strong rejection of environmental determinism in American geography was led by Carl O. Sauer in the 1920s. For Sauer, the primary purpose of geography should be chorology—or the study of areas. Rather than constrain geographers within the limits of environmental influences, geography should study places in terms of regular characteristics that tied them together.

1929

The environment of the Earth can be broadly divided into four major systems: the atmosphere, hydrosphere, lithosphere, and biosphere. Russian scientist Vladimir Vernadsky coined the term *biosphere* in 1929.

1930s

A number of geographers with political as well as academic interests made political geography an instrument of nationalism. Notable among them were Rudolf Kjellen, a Swede, and Karl Haushofer, a German who was close to Rudolf Hess, Adolf Hitler's deputy in the 1930s. They developed a school of *realpolitik* and

geopolitik, whose writings were used to give an intellectual rationale to 1930s German expansionism—not only the desire to occupy adjacent territories with substantial German populations, such as Austria and Sudetenland, but also Russian areas further east.

Another geographer and politician, Sir Halford Mackinder, whose classic paper related state power to location, led parallel developments in the United Kingdom. In an era when movement of heavy goods and large armies was easier by sea than by land, maritime countries would dominate politically, but as land transport was becoming easier, so land-based powers were becoming stronger.

Mackinder argued that whoever controlled the “world island” (the heartland of Euro-Asia) should be able to control the globe—a geopolitical notion that influenced much strategic thinking throughout the century, until air power (and then power in space) came to dominate military strategy.

1933

Market geography is a subfield of economic geography, which focuses on the spatial nature of market forces. It derives its rationale from the central place theory, first argued in 1933 by German economic geographer Walter Christaller in his book on central places in southern Germany.

1937

Alexander L. Du Toit, a South African geologist, suggested two primordial continents: Laurasia in the north and Gondwanaland (or Gondwana) in the south.

1939–45

World War II marked the first time there was a truly global conflict or war, including Europe, the Americas, Africa, and Asia.

1939

The turn to the study of geographic regions gives birth to the areal differentiation movement in the mid-1930s with Richard Hartshorne’s publication of *The Nature of Geography*.

1947–56

The Dead Sea (the lowest dry point on Earth at 1,292 ft below sea level or -395 m) became famous for the Dead Sea Scrolls, found in eleven caves in nearby Qumran from 1947 to 1956. Literally thousands of Biblical fragments and ancient Jewish documents were found, which added greatly to the understanding of

these religions. Today, the shores of the Dead Sea contain popular beaches, resorts, and spas.

1948

A young meteorological theoretician, Jule Charney, succeeded in deriving simplified mathematical models of the atmosphere’s motions, based on earlier work. The results were dramatic: air flow patterns over North America were accurately forecast 24 hours in advance with greater skill than ever before.

1950s–60s

With few exceptions, the elite—aristocrats, government officials, clergy, and the wealthy—lived in the center of ancient cities, which were usually located near the most important temples. Farther out were the poor, who sometimes huddled along the city walls together. However, the situation reversed in the 20th century, when rings of rich suburbs surrounded most cities and only the poor were left in the city centers. In the United States, the affluent and the middle class who abandoned inner cities populated the suburbs, which grew up around cities in the 1950s and 1960s.

1950

Starting in about 1950, geographic research experienced a shift in methodology. Geographers began adopting a more scientific approach that relied on quantitative techniques. The quantitative revolution was also associated with a change in the way in which geographers studied the Earth and its phenomena.

1952

The European Coal and Steel Community (ECSC) was founded by Germany, France, Italy, the Netherlands, Luxembourg, and Belgium, becoming the predecessor organization to the European Union (EU). The EU included 25 countries by 2004, with many of them adopting the common currency, the euro, to facilitate regional trade and commerce.

1953

The world’s tallest peak, Mt. Everest (29,028 ft or 8,848 m) was climbed by Sir Edmund Hillary and Tenzing Norgay.

1954

The U.S. secretaries of commerce and defense adopted the nautical mile as a means of measurement. It is used in maritime and aerial navigation, in relation to how boat speeds and wind velocities are measured (one

knot is one nautical-mile-per-hour). A nautical mile is approximately one minute of latitude and it used to express distance.

1957

Historian Karl Wittfogel published his book, *Oriental Despotism*, which introduced the concept of water control (hydraulic civilizations) as the basis for the rise and development of civilizations and despotic political systems, from Egypt to China.

1957

The Soviet Union launched the first successful orbiting space capsule, marking the beginning of human use of space for exploration. This led to detailed mapping and monitoring of the Earth's surface, as well as more accurate navigation using global positioning satellites

1960s

Several American scientists, among them Jack E. Oliver and Bryan L. Isacks, integrated the notion of seafloor spreading with that of drifting continents and formulated the basis for plate tectonic theory.

1960s

The widespread introduction of the jet airplane for passenger travel reduced the time needed to reach even the most remote part of the globe. It resulted in massive expansion of business travel and new geographic linkages. Time and distance began to diminish in terms of interaction between once distant places.

1960s–70s

With the advent of the environmental movement in the 1960s, and the subsequent oil crisis and surging energy cost, energy studies became increasingly popular in the 1970s in geography as well as in the general research community.

1960s–70s

This period marked the beginning of the computer age and digital information revolution. Computers and the internet connected the world, regardless of time, distance, or culture: the first example of a global “village.”

1970s

A revival of interests in political geography from the 1970s onward was initially linked to the “quantitative revolution,” which the wider discipline experienced in the 1960s and 1970s. Work on electoral geography started then and geographers increasingly brought

their spatial perspective to bear on a range of subjects broadly defined as “political” and relating in some ways to the operation of the state. Location and conflict (over land uses, public goods, and so forth) became topics considered by political geographers.

1979

The First World Climate Conference made climate change, or global warming, an international issue as it called on all governments to anticipate and prevent human alterations in climate.

1980s

The first commercial geographic information systems (GIS) are developed that relate spatial information to assets, phenomena, or events. A GIS is computerized, and, therefore, is a structured and integrated arrangement of computer hardware, software, and operating procedures and principles designed to support the management of spatial and nonspatial data. These data are collected often via satellite coordinates referenced to the Earth and are maintained in a database.

1983

In *The Fractal Geometry of Nature* (1983), Benoit Mandelbrot writes, “Clouds are not spheres, mountains are not cones, coastlines are not circles, and bark is not smooth.” In an effort to more properly analyze and represent nature mathematically, Mandelbrot developed a new geometric pattern called a fractal.

1995

Again in the news as an international issue, the location of the International Date Line has posed a navigation and time problem since at least the 1700s. In 1995, the line had a minor adjustment so that the new country of Kiribati would be entirely on the same side and the same day, and be the first to mark the new millennium.

1990s

The internet together with a new generation of related computer software and hardware produced a revolution in how we conceptualized and interacted with geographic places and spaces. This revolution was sustained by the continual diffusion of information and communication technology (ICT) into many segments of a globally connected society. These ICT forms include immersive multimedia, video conferencing, computer-aided design, electronic surveillance, consumer profiling, and virtual realities. Virtual geography refers



to the creation of artificial geographies for communication and interaction purposes using concepts from the field of virtual reality (VR).

1991

In August, as Soviet leader Mikhail Gorbachev and his family were vacationing in the Crimea, a cabal of hard-liners staged a coup and held Gorbachev under house arrest. The coup failed because the military refused to carry out the coup leaders' orders. Events continued to spiral out of control as the constituent republics of the Soviet Union clamored for more autonomy and, in the case of the Baltic republics, independence. After an impasse on the relationship between Moscow and the republics, the Soviet Union ceased to exist on December 25, 1991.

1993

The United States, Canada, and Mexico signed the North American Free Trade Agreement (NAFTA), which created a regional free trade zone that lowered tariffs and trading restrictions. NAFTA encouraged greater opportunities for cross-border investments and movement of goods and services among the three countries. The agreement went into effect in 1994.

1996

The Association of American Geographers acknowledged military geography as a subfield of geography and defined it as the application of geographic information, tools, and techniques to solve military problems in peacetime or war. The consideration of terrain, culture, politics, and economics in the pursuit of warfare remains a dynamic field of geographic study and a practical area of military application.

1997

More than 150 nations signed the first legally binding treaty, the Kyoto Protocol, aimed at cutting emissions of the main greenhouse gases believed to contribute to global warming. Later, the United States, under President George W. Bush, declined to participate in the protocol.

1997–98

The El Niño of 1997–98 was one of the worst in recent memory. The weather system caused vast fires in Indonesia and large economic losses impacted many

areas, such as Australia and Southeast Asia, where drought occurred. Ironically, this El Niño came with much advance warning, and heavily populated areas like California were able to invest millions of dollars in preparation, thus avoiding more losses.

Groups such as the National Oceanic and Atmospheric Administration (NOAA) predict and track El Niños using satellites, research ships, buoy arrays, computer modeling, and other tools to analyze ocean temperatures, wind speeds, fish populations, precipitation, and other early indicators of developing weather systems.

2001

The terrorist attacks of September 2001 leveled New York City's landmark World Trade Center towers and killed more than 2,700 people. This was the start of an aggressive U.S. strategy to fight al-Qaeda and other terrorists on a global basis.

2004

Russia ratifies the Kyoto Protocol, the United Nations convention on climate change, which sets limits for the emission of greenhouse gases that contribute to global warming. The United States declines to sign the agreement, citing unfair quota levels for emissions from developed and developing countries.

2016

James Alcock, a professor at Pennsylvania State University, has estimated that at the current rate of destruction, the point of no return in the Amazon rainforest could be reached as early as 2016. Unchecked destruction could entirely wipe out the rainforest by the middle of the 21st century.

2050

It is speculated that one result of the continuing population explosion will be the creation of megalopolises, concentrations of urban centers that may extend scores of miles. It is thought that the first such growth could occur on the East Coast of the United States, where there may eventually be a single urban agglomeration stretching from Boston to Washington, D.C. Other emerging megalopolises include the Tokyo-Osaka-Kyoto complex in Japan, the region between London and the Midland cities in Great Britain, and the Netherlands-central Belgian area.





## abyssal plain

LOCATED IN THE world's oceans, an abyssal plain is a depositional surface on the seafloor. The plain is generally 13,000 to 20,000 ft (4,000 to 6,000 m), extending seaward from the base of a continental slope or from the seaward edge of an oceanic trench to the mid-ocean ridge. The term *plain* implies that this part of the seafloor is a monotonous, uninteresting place. Actually, the plain is remarkable for its sediments, manganese nodules, and life forms.

Much of the abyssal plain consists of tiny particles of brown and red clays, contributed to the ocean by wind deposition and volcanic eruptions. The shells of microscopic marine organisms also make up a significant portion of the sediments. Quiet waters of the deep ocean do not disturb the particles as they accumulate on the ocean floor. Marine scientists study the sediments to glean data about the age of the ocean floor and changes in the ocean's depth, temperature, salinity, and circulation. This information provides clues to geographers and other scientists about millions of years of change in regional and global climate.

Turbidites are distinctive layers of sediments on the edges of abyssal plains next to continental slopes. Turbidites come from river sediment deposited on the outer edge of the continental shelf. Turbidity currents move the sediments from the shelf to the plain. The

currents are slurries of water and suspended sediments. They rush down continental slopes similar to an avalanche, and the resulting turbidites form tongue-like abyssal fans usually near the mouth of a river or submarine canyon.

Turbidites also spread farther out on the plain. They are less abundant in the PACIFIC OCEAN than in the ATLANTIC and INDIAN oceans, because fewer large rivers supply sediments to the Pacific Ocean and its deep-sea trenches trap sediments, preventing their spread to the abyssal plain. Seamounts (submerged mountains) rarely interrupt the abyssal plains of the Atlantic and Indian oceans, as turbidites in these oceans bury most of the mountains. In contrast, many seamounts rise above the abyssal plains in the Pacific Ocean because of a paucity of turbidites there.

These mysterious, potato-size rocks litter the surface. They have thin concentric layers of metals such as iron, cobalt, copper, nickel, and manganese. Chemical reactions in the water add layers that are 0.4 to 8 in (10 to 200 mm) thick every million years. Scientists do not agree on how the nodules form. Some investigators feel that biological productivity in overlying waters control the accretion of metals.

Others argue that the midocean ridge's hydrothermal vents, which exhale such metals from the Earth's interior, are responsible. The metals have aroused interest in the nodules' economic value. Presently, the

nodules are too expensive to mine because of the cost of extracting them from the ocean floor.

The abyssal environment is not conducive to life as we know it; it is perpetually dark and very cold, and the food supply is sparse. Moreover, hydrostatic pressure is enough to crush a person's body to the size of a soccer ball. No plant life exists because of a lack of sunlight. The animals—primarily small worms, crustaceans, and mollusks—are scavengers. They live off bacteria on the seafloor and fecal pellets, bones, carcasses of large animals, and dissolved material that filters down the water column. Population densities are low owing to a harsh environment and scarcity of food.

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## Aceh

ACEH (full name: Naggroe Aceh Darussalam, meaning “the Abode of Peace”) is one of the three “special territories” among the 27 administrative provinces of INDONESIA. Its location, on the large island of SUMATRA in the northeast corner of the Indonesian archipelago, facing the Andaman Sea and the Straits of Melaka, makes it the closest Indonesian departure point to Mecca, from which it gets the label “veranda of Mecca.” The label is also appropriate on account of the evidence that the Acehnese have the longest history of conversion to Islam in Southeast Asia, dating back to the 9th century, and today as a group represent one of the most staunch adherents of the faith in the region.

Aceh was able to survive as an independent Muslim kingdom since its inception in the early 16th century up to the late 19th century, when it became entangled in a power struggle between British and Dutch colonial interests. Through an Anglo-Dutch treaty in 1824, the British transferred control of some of its possessions to the Dutch, who agreed to allow

the independence of Aceh. In 1871, against the neutral positions taken by the Americans and Europeans, the British allowed the Dutch to invade Aceh, possibly to avert French encroachment in the region, but they were never able to pacify Acehnese resistance, which lasted until World War II. In 1949, the Dutch handed their possessions in the Malay Archipelago to Indonesia, without ever consulting Aceh.

The newly independent Indonesian government immediately dispatched troops to annex Aceh, resulting in widespread resentment of what was viewed as foreign occupation. In 1959, as a way of appeasing the Acehnese, Indonesia conferred on Aceh the status of a “special territory,” allowing a degree of autonomy in matters affecting religion, education, and provincial administration. While this move placated those in favor of a union with the rest of Indonesia, the pro-independent movement remained and subsequently went underground under the name Gerakan Aceh Merdeka (GAM), or Aceh Independence Movement.

In the face of secessionist movements in two other provinces (EAST TIMOR and Papua), the central government declared Aceh as a Military Operations District (Daerah Operasi Militer) in 1989, in a large-scale effort to eliminate GAM. After a decade of oppressive campaigns resulting in nearly 3,000 casualties and the destruction of homes and sources of livelihood, military operations were withdrawn partly in response to worldwide protest and criticism against the Indonesian government.

As of late 2004, the outcome of the Acehnese struggle for independence remains to be seen. The options being deliberated in the media include: continue to fight for outright independence; hold a referendum to allow for popular choice whether to secede or not; or engage in a dialogue with the central government under United Nations auspices to uphold the agreements ratified in the “special territory” status. The most contentious issue concerns the right of the province to enjoy its resources (petroleum and timber).

This “Abode of Peace” was struck by a series of tsunamis, or tidal waves, on December 26, 2004, resulting in more than 100,000 deaths in Aceh and nearby areas of Indonesia. The tsunamis were created by a massive earthquake, registering 9.0 on the Richter scale, in the Indian Ocean. Into 2005, Aceh struggled not only with the issues of independence but also with rebuilding its flood-ravaged territory and economy.

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## Aconcagua Mountain

ACONCAGUA MOUNTAIN LIES west of Mendoza, ARGENTINA, entirely within Argentina, and immediately east of Argentina's border with CHILE. The mountain is, at 22,834 ft (6,960 m), not only the tallest mountain in the Western Hemisphere, but also the highest outside of Asia. Its twin peaks, the northern of which is the tallest, can be seen from the coast of Chile 100 mi (162 km) away.

There are different interpretations of the origin of the name *Aconcagua*. It may be derived from the native Quechua *akun* ("summit"), *ka* ("other"), and *agua* ("admired" or "feared"). Thus, it is translated from Quechua as a summit that is feared or admired. Another version is that the name is derived from Arauca roots. Thus, Aconca-Hue is a Mapuche name for the corresponding Aconcagua River that, from Chile, "comes from the other side."

The relatively new mountain was created by subduction of the Nazca plate beneath the South American plate. Geology of the Aconcagua area can be grouped in three basic time periods: a base that developed before the Jurassic period, Mesozoic sequences, and coverings from the Cenozoic period. Glaciers on Aconcagua include Lower Horcones Glacier, the Upper Horcones Glacier, the Los Polacos (or Los Relinchos) Glacier (a climbing route), and the Güssfeldt Glacier. Glaciers on Mount Aconcagua are, owing to more arid conditions, less pronounced than those to the south in Patagonia.

Most of the vegetation and wildlife, because of the aridity and the short growing season at high elevations, are concentrated below 13,123 ft (4,000 m). Typical vegetation is low-growing brush (STEPPE) adapted to low temperatures, thin soils, and high winds. Brush species include *lena amarilla*, *vareta*, and *cuerno de cabra*, with grass species including *buecu* and *coirones*. Wildlife such as the condor, mora eagle, puma, and red fox migrate to lower elevations during winter. Mountain mice hibernate on site. Streams harbor chorlos, churrines, and torrent ducks. Guanacos (similar to lla-



*Aconcagua Mountain in Argentina, at 22,834 ft (6,960 m), is the tallest mountain in the Western Hemisphere.*

mas) can gather in large groups. Hares introduced from Europe are plentiful. Aconcagua Mountain is a provincial park. It was included in 1983 as part of a network of 10 protected areas of the province of Mendoza. It is designated as a Protected Wilderness Area, based on its scenic, recreational, cultural, genetic, and biodiversity values. These areas serve as a reference in relation to similar yet degraded habitats.

General Don José de San Martín crossed the Andes near Aconcagua to liberate the Chilean area from the Spanish in 1817. His army of more than 5,300 men, 9,280 mules, and 1,600 horses crossed at more than 13,123 ft (4,000 m) in elevation. In 1835, Charles Darwin was one of the first European scientists to collect data about the mountain. In January 1985, a remarkable discovery was made by Argentine climbers—an Inca cemetery at 17,388 ft (5,300 m) in elevation. The site included circular stone walls, a mummy, and six statues—three human and three llama figures.

Although the mountain is a large, singular massif, thus nicknamed the "Centinel del Piedra" (Stone Sentinel), various peaks around Aconcagua also surpass 16,404 ft (5,000 m).

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The Adriatic Sea, between Italy and the Balkan Peninsula, is important for tourism and fishing tuna, sardines, and lobster.

## Adriatic Sea

THE ADRIATIC SEA (in Italian “Mar Adriatico,” in Serbian “Jadransko more”) is a northwest-to-southeast arm of the MEDITERRANEAN SEA. The sea separates the Italian peninsula from the Austro-Hungarian, Montenegrin, and Albanian littorals, and the Italian Apennine Mountains from the Balkan Dinaric Alps. The western coast is Italian and the eastern comprises SLOVENIA, CROATIA, BOSNIA AND HERZEGOVINA, SERBIA AND MONTENEGRO, and ALBANIA. The name derives from the Italian town of Adria (Hadria), designating in early historic times the sea’s upper portion. The term was later extended geographically to the south.

The Adriatic has a total surface area of about 60,000 square mi (160,000 square km), with a maximum length of about 480 mi (770 km) and a width of nearly 100 mi (160 km); however, the Strait of Otranto, connecting the Adriatic and the Ionian Sea to the south, is 45 mi (72 km) in breadth. The mean depth is 133 fathoms (240 m), but the northern portion of

the Adriatic is shallowest between the southern promontory of Istria and Rimini (about 25 fathoms or 46 m), where the low Italian littoral merges in the northwest into marshes and lagoons along the delta of the Po River. The freshwater Po and Adige are the major rivers flowing into the saline Adriatic and account for substantial silting. The Po’s sediment extended the coastline for 2 mi or 3.2 km within the last two millennia.

The area between Šibenik and Ortona (Croatia and ITALY) exceeds 100 fathoms (180 m) in depth, but west of Durrës (Albania) and south of Dubrovnik (Croatia), the basin exceeds 500 fathoms (900 m). The rocky east coast has many long and narrow islands with the long axes lying parallel to the mainland coast and elevations of a few hundred feet; larger islands such as Brac have elevations of 2,552 ft (778 m). There are more than 1,000 islands in the Adriatic, although only 66 are inhabited, notably near Venice (Italy), and Trieste (Italy). Due to eutrophication and minimal tidal flow, making the sea a shallow, closed system, the Adriatic has notable water and air pollution yet remains an important tourism and fishing locale.

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## Aegean Sea

THE AEGEAN SEA is an arm of the MEDITERRANEAN SEA, located between the Greek peninsula to the west and TURKEY to the east. The Aegean is connected through the Dardanelles, the Sea of Marmara, and the Bosphorus with the BLACK SEA, while the island of Crete is considered to be the southern boundary. In all, it is about 380 mi (611 km) long and 186 mi (299 km) wide. It has a total area of approximately 83,000 square mi (214,000 square km).

As for the name *Aegean*, there are several explanations: 1) named after the town of Aegae; 2) derived from the queen of the Amazons, Aegea, who died in the sea; and 3) stemmed from Aegeus, the father of Theseus, who drowned himself in the sea when he mis-

takenly thought his son had died in a distant war. The formation of the sea occurred when the Tethys Sea or Seaway began to shrink over the last 120 million years as the approaching African and European plates closed off the Mediterranean and surrounding seas.

During the last Ice Age (2,000,000 to 18,000 B.C.E.), the shallow and narrow Straits of Gibraltar blocked off much of the ATLANTIC OCEAN waters, which led to a saline crisis as a high rate of evaporation in the nearly arid region created a shallow, briny basin. Even today, the generally shallow (average depth of 4,921 ft or 1,500 m) Mediterranean Sea has a low exchange rate with the Atlantic and is saltier. The maximum depth of the Aegean is found east of Crete, where it reaches 3,543 m (11,627 ft). The rocks that make up the floor of the sea are mainly limestone, though proximity to a plate boundary has allowed volcanic activity to alter it.

The Aegean is studded with numerous large and small islands that are the mountain peaks of Aegeis, the name given to a submerged land mass. The Aegean islands can be divided into seven groups: the Thracian Sea group, the East Aegean group, the Northern Sporades, the Cyclades, the Saronic Islands, the Dodecanese, and Crete.

North winds prevail over the Aegean Sea, although periodically, the cold gale-force Bora katabatic drainage wind thunders into the sea from the Balkans. The low tides generally follow those of the eastern Mediterranean. However, the tide of Euripus, the strait between Greece and the island of Euboea, demonstrates a violent and uncertain character, leading to the term the *Euripus Phenomenon*. Cold water masses with fluctuating temperatures flow out of the higher BLACK SEA, impacting the deep waters of the Aegean. The low concentration of phosphates and nitrates, necessary for marine life, limits fishing to sardines and sponges. Likewise, the barren, rocky soil hinders agriculture. Thus, tourism remains the major source of income for the Aegean coastal countries.

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The Aegean Sea lies between Greece and Turkey, bridging the lands of western Europe and the Middle East.

## Afars

THE AFAR PEOPLE live in the rocky desert terrain of eastern Africa, in an area called the HORN OF AFRICA. Most of them live in the countries of DJIBOUTI, ETHIOPIA, and ERITREA. The territory, once known as the French Territory of the Afars and Issas, became Djibouti in 1977, when France gave the people their independence. Although most Afars live in the desert, some live in the Awash Valley and the forests of northern Djibouti. They number about 1.4 million in all. The name *Afar* comes from the first two letters of Africa and Arabia.

The Afars are a cohesive group and did not like having their territory broken up into the countries of Djibouti, Ethiopia, and Eritrea. The Afars in Djibouti are outnumbered by the Issas and were unhappy with the Issa leadership. There was much unrest among the Afars during the 1990s, but a peace accord was finally signed in 2001. Djibouti is important because of its

strategic position at the mouth of the RED SEA. It serves as a port for goods leaving and entering eastern Africa.

Although peace now reigns in Djibouti, the Afars are the target of economic and political discrimination. The Afar people are tall and proud, with narrow, straight noses, thin lips, and small, pointed chins. The Afars are known as fierce fighters. They have managed to survive under the worst conditions in one of the hottest areas in the world. The Issas are their main enemies. A man is judged on his bravery and strength among the Afars.

The Afars subsist mostly on a diet of bread and milk, and many are malnourished. They are often anemic and are prone to malaria because of their poor diets. Historically a pastoral people, over half of the Afars live a nomadic life, moving their livestock wherever they can find grazing. They raise sheep, goats, camels, and cattle. Rainfall is sparse in the area, so the people are forced to move often in search of grass for their animals. Both droughts and floods have had a negative effect on the economy of the Afars. Some Afars living along the Red Sea fish for a living. The Afars have also mined salt for many years and export it to Ethiopia.

Most Afars embrace the Muslim religion, which differentiates them from other tribes in the area that are Christian. Muslim practices are supplemented with ancient animist customs as well.

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## Afghanistan

**Map Page** 1123 **Area** 250,000 square mi (647,500 square km) **Population** 28,717,213 **Capital** Kabul **Highest Point** 24,550 ft (7,485 m) **Lowest Point** 846 ft (258 m) **GDP per capita** \$700 **Primary Natural Resources** natural gas, petroleum.



THE STATE OF AFGHANISTAN is a landlocked country that borders PAKISTAN to the south, IRAN to the west, TURKMENISTAN, UZBEKISTAN, and TAJIKISTAN to the north, and CHINA to the northeast. The country is divided into 32 provinces. Since the overthrow of the Taliban in 2001, Afghanistan is in the process of reconstructing its government.

Afghanistan, known since ancient times for its lapis mines, is divided by several mountain ranges. Cutting the country in half is the HINDU KUSH, from which smaller ranges project: from the Band-I-Turkestan on the west to the Suleiman Range to the east. To the southeast is the Dasht-I-Margo desert. Afghanistan has a dry climate with hot summers and cold winters. The country experiences sparse rainfall. Its chief rivers are the AMU DARYA, the Kabul, the Helmand, and the Hari Rud. Major cities include Kabul, Kandahar, Herat, Mazar e-Sharif, Jalalabad, and Konduz.

### ANCIENT LANDS

The region in and around Afghanistan has been inhabited since the Paleolithic and Neolithic eras. Afghanistan has been the scene of migrations throughout history. Since ancient times, Afghanistan captured the interest of foreign peoples. The region of what is now Afghanistan entered into recorded history under the PERSIAN EMPIRE. By 331 B.C.E., Alexander the Great extended his empire into Afghanistan after conquering Persia. Alexander's empire disintegrated after his death in 323 B.C.E. with Afghanistan passing to Seleucis Nikator, one of his generals. Afghanistan soon after came under the control of Chandragupta from INDIA. Around 650 C.E., ISLAM came to Afghanistan through Arabs who conquered the Sassanids in Persia. In 1219, the Mongols under Genghis Khan spread destruction throughout Afghanistan. For 500 years, Afghanistan was part of the power plays between the Mughals in India and the Safavids in Persia. In the 18th century, Afghanistan was united for the first time under Ahmed Shah Durrani, who created an empire that included modern-day Pakistan.

By the 19th century, Afghanistan was caught in the middle of the imperial ambitions of Britain, which had controlling interests in India and RUSSIA. Britain fought two wars to gain control of Afghanistan, both of which ended disastrously. In the 20th century, Afghanistan entered a period of modernization through King Amanullah between 1919 and 1929. In 1933, King Mohammad Zahir Shah extended the modernization through the creation of a constitution and a parliament. However, by the 1960s, the communists had

gained a foothold in Afghan politics, and by 1973, Sardar Mohammad Daoud abolished the monarchy and established a republic with financial backing from the Soviet Union.

In 1979, the Soviet Union invaded Afghanistan to support a communist government under the Najibullah regime. Soviet occupation was met by fierce resistance by the Mujahideen, who were mainly supported by the United States. In 1989, the Soviets withdrew from Afghanistan, prompting civil war among the Mujahideen. By 1996, Afghanistan fell under the rule of the Taliban, a fanatical extremist Muslim sect. The Taliban imposed Sharia law as the legal system for Afghanistan and severely restricted women's rights. Additionally, Afghanistan became a breeding ground for international terrorism, harboring Osama bin Laden, leader of the al Qaeda terrorist group that masterminded the attacks in New York City and Washington, D.C., on September 11, 2001.

In November of that year, the United States led a coalition of nations to overthrow the Taliban regime, when it would not surrender bin Laden. The Taliban offered no significant resistance and retreated to the mountains. At the end of 2001, an agreement was reached in Bonn, Germany, to lay out a blueprint for Afghanistan's reconstruction.

Afghanistan has a diverse array of ethnic groups. The Pashtun are the majority ethnic group, followed by Tajiks, Uzbeks, Hazara, Aimaq, Turkmen, Baluch, and Nuristani. Pashto and Dari are the main languages spoken. Twenty years of war have left Afghanistan's infrastructure in ruins. Agriculture makes up 60 percent of the economy. Afghanistan is one of the leading exporters of opium, which is most profitable for farmers to grow.

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## Agricultural Revolution

AROUND 11,000 B.C.E., human beings began to domesticate and cultivate plants. This new activity, which eventually changed populations, lifestyles, and the en-

vironment in profound ways, proceeded in sporadic bouts. Although the development of agriculture took place over millennia on different continents, its initial beginning is sometimes referred to as the Agricultural Revolution.

Archaeological evidence shows that men and women began cultivating grains between 12,000 B.C.E. and 10,000 B.C.E. in the Middle East. Sites in the ZAGROS MOUNTAINS of IRAN, TURKEY, SYRIA, and the Jordan River Valley, collectively known as the FERTILE CRESCENT, all indicate that cereal grains were first deliberately grown there by farmers. This region contains over 50 archaeological sites from 8,000 to 10,000 years old, all giving evidence that agriculture was practiced. Specifically, the earliest sites found are along the Levant Corridor, which runs south from the mid-Euphrates River valley to the lower Jordan River valley. The Natufian complex of the Levant provides archaeological evidence of farming villages that date from 10,500 B.C.E. While the cereal grains harvested there were still considered wild, they may have been planted intentionally, in plots cleared for the seeds. The Natufians, living in what is now northern ISRAEL and Jordan and southwest Syria, established permanent homes, stored food in stone jars, and used grindstones, mortars, and pestles to process grain.

Farming is more labor-intensive than hunting and gathering; the motivation for changing from one lifestyle to the other is not known. Climate changes and glacial retreats in the previous millennia may have led to increased yields of wild plants. Hunters and gatherers, noticing the increase, may have developed cutting tools and storage facilities to take advantage of the abundance of grain.

Other factors that may have prompted the switch to sedentary farming include the decline of at least one animal, the wild gazelle, which had been a significant food source in the Fertile Crescent. Research scientists have also put forth population expansion and the social pressure upon village leaders to provide feasts as possible explanations for the development of local agriculture.

### EARLY FARMERS

The harvesting and selection methods of early gatherers, who eventually became farmers, changed growth patterns and made domesticated plants different from their wild varieties. Larger and sweeter fruits, peas, and legumes were eaten more often, and their seeds were the ones collected and germinated. In the case of wheat, only stalks on which the seeds stuck to the stalk



were collected by people, and thus cultivated wheat came from these seeds and is easily identifiable. The stalks of wild wheat tend to break and scatter their seeds on the ground.

Archaeologists use radiocarbon dating on plant material; by plotting where the earliest domesticated plants are found, they can chart the spread of cultivation. As an example, remains of ancient, wild varieties of emmer wheat are found in Israel, Turkey, and Iran. Emmer wheat was the most common cultivated grain. The earliest example of domesticated emmer wheat was found in the Fertile Crescent area and dates from 8500 B.C.E. The earliest instances found of this crop in Europe date from 6800 B.C.E. in GREECE, then 6000 B.C.E. in GERMANY. Advances in radiocarbon dating over the last two decades have led to corrections in previously published dates and confusion in books.

Emmer wheat, einkorn wheat, and barley were domesticated by 8000 B.C.E. in the Levant, and within three centuries the people of this region were intentionally sowing all their wheat from stored seed. The wild variety of these three grains was no longer being consumed. Also by 8000 B.C.E., cereals were being introduced in areas where they had not previously grown wild, and farmers were selecting seeds for qualities that would increase crop yield.

From this area, agriculture spread both east and west. The similar climates and lack of insurmountable boundaries in those directions allowed this. Agriculture reached eastern Europe and EGYPT by 6000 B.C.E., and spread to western Europe, North Africa, INDIA and southern Asia by 3000 B.C.E. The sharing of new cultivation techniques to the north and south, however, was impeded by differences in weather such as extremes of cold and lack of sufficient rain. The eight major crops, called founder crops, developed in the Fertile Crescent during the Agricultural Revolution were emmer wheat, einkorn wheat, barley, lentils, peas, chickpeas, bitter vetch, and flax—which produces both oil and the fabric linen.

Rice and millet were cultivated in river valleys of CHINA, starting from 6500 to 5500 B.C.E. In the Americas, the earliest evidence of cultivation dates to 4000 B.C.E. and is found in the lowlands of northern South America. There is evidence of cultivation in New Guinea dating to 7000 B.C.E. Sub-Saharan Africa developed agriculture by 2000 B.C.E., as did some areas of eastern North America and Central America. In pointing to these independent developments, though, it is important to remember that the archaeological evidence is sparse, scattered, and often hit-and-miss. Im-

portant sites bearing new data may have been destroyed over the years or have not been discovered.

Agriculture changed the landscape, wherever it was implemented. Fields, plowed and uprooted of their native, variegated plant species and forced to grow only one particular plant, became depleted of some nutrients and inhospitable to certain animals and insects that lived there in the past. Other animals that could live on the cultivated plants were therefore favored and become more numerous.

### ANIMAL DOMESTICATION

The domestication of animals often occurred in conjunction with the domestication of plants, since the latter led to permanent settlements in which herds of animals would be penned in to ensure a food source. As early as 9000 B.C.E., sheep were being bred and domesticated in the ZAGROS MOUNTAINS. Cattle were domesticated in the area by 6000 B.C.E.

Before men and women farmed, they had to travel from place to place, and from season to season, finding their food where it grew wild. People did this for thousands of years. Being able to control food production, and to store or sell excess crops, meant that families had to stay with their fields and land. They built permanent homes and storage facilities. Villages grew, and over many generations, the specialization of labor developed. Those who farmed could sell food to those who performed other tasks: the stonemasons, carpenters, weavers of cloth, and so on.

Since excess food, cleverly traded, could lead to wealth and power, a stratified political and economic class rose, probably over generations—perhaps even over centuries. Food and wealth had to be protected, so means to ensure social control became part of life. Large communities of people meant strength in numbers and led to military conquests and aggression. The famous, protective walls of Jericho, where wheat, barley, and figs were cultivated, were constructed around 8000 B.C.E.

There were clear disadvantages and threats inherent in the agrarian lifestyle. Larger and larger communities became dependent upon fewer varieties of food and vulnerable to shortages caused by droughts or variations in weather, as well as pests and diseases. Famine and starvation were constant threats. Also, populations grew more rapidly when they became settled and permanent. Mothers in hunter-gatherer groups limited births because the group needed to be mobile to survive; too many infants to carry would slow it down. In a farming society, however, mothers

tended to have more babies, closely spaced. Because surplus food facilitates population growth, more and more food needed to be grown. These are problems that continue to affect all areas of the world.

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## Ahaggar Mountains

THE AHAGGAR IS a large mountainous plateau region lying on the TROPIC OF CANCER in the north-central SAHARA DESERT. It covers an area of 210,000 square mi (543,900 square km) which is about the size of FRANCE, or of ARIZONA and NEW MEXICO combined. It is about 1,000 mi (1,609 km) east of the ATLANTIC OCEAN, 1,000 mi north of the BIGHT OF BENIN, and 1,000 mi south of the MEDITERRANEAN SEA.

Most of the Ahaggar lies in southeast ALGERIA about 900 mi (1,450 km) south of Algiers. However, small areas extend into NIGER in the south and LIBYA in the northeast. The Ahaggar is a part of the Mid-Sahara Rise, which stretches 1,300 mi (2,092 km) east to west and 965 mi (1,553 km) south to north. The Mid-Sahara Rise includes the Adrar des Iforhas Mountains in MALI and the Massif de l'Air Mountains in Niger.

The Sahara lies on the African shield, a thick pre-Cambrian crystalline base. Geological studies have concluded that about 300 million years ago violent earthquakes of enormous proportions pushed up this central massif or plateau region of the Sahara. This was followed by volcanic eruptions that poured enormous beds of basaltic lava over the area.

The geologic activity underlying the Ahaggar plateau pushed its granite base up thousands of feet above the Sahara. The Ahaggar plateau's height is

above 3,000 ft (915 m). The geologic activity produced enormous cliffs and fissures. These were broken into strange formations. At the heart of the Ahaggar, volcanic eruptions produced pumice and lava beds in many areas, some of which are basaltic. There are also "organ pipes" or volcanic needles or spires of rock that may reach 1,000 ft (305 m) high.

The Ahaggar Mountain chain, which is also called the Hoggar Mountains, is situated on top of the Ahaggar plateau. The plateau is like a platform covered with lava fields. The Tuaregs call the platform the Atakor, while the Arabs call it the Kudia. The Atakor platform averages 6,600 ft (2,012 m). At the heart of the Ahaggar chain is the Atakor range, which has extinct volcanoes in many places that rise to about 9,000 ft (2,743 m). They rise from the plateau and are the highest portion of the plateau. At the center of the Ahaggar Mountains is the highest peak, Mount Tahat (9,573 feet or 2,918 m). Other peaks include Mount Atakor and Mount Assekrem, which is where the Berber Tuaregs locate the "end of the world."

While most of the Ahaggar is waterless and totally bare of vegetation, there are occasional snows. In some places in deep ravines, there are verdant strips that can be seen on aerial photographs. There are two waterfalls in the Ahaggar. One is at Tamekrest and the other is at Imeleoulaouene. A variety of animals live in the mountains along with the nomads, mostly Tuaregs, who frequent the oases located in these rugged reaches.

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## Alabama

THE HEART OF THE Confederate States of America during the Civil War, much of the state of Alabama was originally part of GEORGIA, its eastern neighbor in the south-central UNITED STATES. The British and French fought over the southernmost area until it was ceded to



the British in the War of 1812. Scholars disagree on whether the state was named for the Alabama River or the Alibamon Indians who resided in the area during the period of the Creek Confederacy. Alabama is bounded on the east by Georgia and the Chattahoochee River, on the west by MISSISSIPPI, on the north by TENNESSEE, and on the south by FLORIDA and the ATLANTIC OCEAN.

Alabama encompasses 52,423 square mi (135,774 square km), ranking 30th in size among American states. The largest cities are: Birmingham, Montgomery (the capital), Mobile, Huntsville, Tuscaloosa, Dothan, Decatur, Auburn, and Gadsden. Alabama's major rivers are the Mobile, Tombigbee, Alabama, Tennessee, Chattahoochee, and the Tensaw. The largest lakes in the state are Guntersville, Wilson, Martin, West Point, and Lewis Smith.

While the coastal area of Alabama boasts a subtropical climate, the climate in most of the state is temperate with average temperature ranges from 91.5 degrees F (33 degrees C) in the summer to 30 degrees F (-1 degree C) in the winter. While rain falls throughout the year, most of the state rarely sees snow. The average rainfall for the state is 53 in (134 cm). The average elevation of the state is 500 ft (152 m) above sea level. The highest point in the state is located at Cheaha Mountain, "high place," 2,407 ft (734 m) above sea level. The lowest elevation in the state is where the land meets the sea in the Gulf of Mexico.

Russell Cave near Bridgeport provided a haven for Native Americans from 6000 B.C.E. to 1650 C.E. The cave, which is now cared for by the National Park Service, provides a first-hand look at the tools, weapons, and the day-to-day lives of Native Americans. Moundville Campgrounds near Tuscaloosa has also preserved vestiges of Native American life.

The terrain of Alabama ranges from the coastal plains in the southern part of the state near the Gulf of Mexico to the rugged terrain of the northern section of land where Alabama merges into Tennessee. Alabama is made up of five major land areas: the East Gulf Coastal Plain, which covers roughly two-thirds of the state, excluding the section known as the Black Belt Prairie, where many plantations were located during the antebellum period; the Piedmont Upland found in the central section of Alabama, which is made up of low hills and sandy valleys; the Appalachian Ridge and Valley, which is made up of sandstone ridges and limestone valleys; the Cumberland Plateau, also known as the Appalachian Plateau, which is made up of varying sections of rolling hills and flat areas; and the Highland

Rim in the northwest corner of the state, which makes up part of the Tennessee River Valley. The section of the East Gulf Coastal Plain around Mobile, which is the state's largest seaport, is low and swampy. In the plains of southeastern Alabama, known as the wire-grass section, the soil is the most fertile within the state. Farming flourishes in this section with its fertile soil and easy water access. Waterfalls and caverns are found throughout the mountainous area of north Alabama.

Until the beginning of the 21st century when manufacturing, government, and services began to dominate the economy, Alabama's productivity was largely dependent on farming. Alabama's economy continues to benefit from the production of farm products that include cotton, peanuts, corn, and hay. Chicken, cattle, dairy products, and hogs provide the majority of the state's livestock exports. Top manufacturing products include textiles, fabricated metal products, transportation, paper, food, chemicals, plastics and rubber, and wood.

Approximately two-thirds of Alabama is forested, and the state is home to more than 125 varieties of trees and more than 150 species of shrubs. Alabama's trees include pines, oak, hickory, cypress, and southern magnolia. Shrub varieties include rhododendron, mountain laurel, azalea, and sumac. Animals found throughout the state include white-tailed deer, red fox, squirrel, muskrat, nutria, beaver, and rabbit. Game birds include ducks, geese, and quail, while the state's most common songbirds are the yellowhammer, bluebird, cardinal, blue jay, and mockingbird. Minerals found in the state include coal, iron ore, petroleum, natural gas, limestone, gravel, bauxite, and clay.

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## Alaska

THE 49th STATE admitted to the union in U.S. history, Alaska is located northwest of the 48 contiguous states. It borders CANADA to the east, the PACIFIC OCEAN to the south, the Bering Sea to the west, and the ARCTIC

OCEAN to the north. Alaska has several distinct physical regions. The southernmost region is named the Pacific Mountain System. The panhandle in the southeast mainly comprises the Alexander Archipalego, while south-central Alaska is made up of the Alaska Range, home to Mount MCKINLEY, or Denali, the highest point in North America at 20,320 ft (6,194 m). The coastal part of this region includes Prince William Sound and Cook Inlet. Lying southwest of the Alaska Range are the Alaska Peninsula and the ALEUTIAN ISLANDS.

To the north of the Alaska Range, up to the Brooks Range, are low hill and valleys, or the Central Uplands and Lowlands. To the west are Alaska's main river valleys (the state's major river is the Yukon, flowing approximately 1,979 mi or 3,185 km) and to the north lies the state's vast treeless tundra.

America's northern state has a rich and diverse past. Before becoming a Russian colony in the 18th century, the land was populated by some 70,000 natives, living in the the interior and southeast portion of the area. Here, the Tlingit and Haidi tracked caribou and fished. The Aleuts who inhabited the outer Alaska Peninsula hunted seals, sea lions, and whales. And the Yupik and Inupiaq Eskimos lived in harsher conditions while hunting for caribou, seal, walrus, and fish.

In the 1740s, Russian fur-trading companies arrived on the Alaskan panhandle, and the way of life for the Aleuts was adversely affected. In 1778, the British explorer Captain James Cook visited the area, and a fur "rush" began. By the end of the century, British, Russians, and Americans were hunting in this newly formed Russian colony, governed by Aleksandr Baranov.

The Russian colony, however, posed many problems for the Russian government. The distance from the Russian capital of St. Petersburg was difficult to overcome and food shortages were prevalent. The Russian settlements in northern CALIFORNIA were also failing as grain suppliers. In 1867, Russia sold its colony of Alaska to the United States for around two cents an acre. Many Americans questioned the deal and thus named the purchase "Seward's Folly," after William H. Seward, the U.S. secretary of state who negotiated the deal.

For the remaining period of the 19th century, the Alaskan territory failed to attract farmers. However, many speculators became involved in the whaling industry, and the Gulf of Alaska turned into a haven for salmon fishing. Between 1878 and 1899, mainly because of Alaska, American canned salmon exports grew significantly. In 1896, gold was discovered in the

Klondike River claim in Canada's Yukon territory, near the border with Alaska. Gold prospectors soon traveled north and traveled through Alaska, and many prospected in Alaskan gold claims. Coastal towns such as Valdez and Juneau (the capital) were created. The gold rush lasted for over a decade, but by World War I, speculators began to dwindle across the territory. In the 1920s, Alaska's white population primarily gathered along main transportation routes and in certain mining areas.

The scene was virtually unchanged until the outbreak of World War II, which witnessed American military personnel being sent to bases in the area. By 1943, 124,000 military personnel inhabited Alaska, and fortifications were created in defense of the Japanese. The Alaska Highway was also finished during this period, which linked Alaska to Canadian railroads. The military remained in Alaska after the war, as part of the distance early-warning (DEW) radar stations to defend against possible Soviet missiles during the Cold War.

### ALASKAN OIL

In 1959, Alaska achieved statehood. In 1968, an arctic oil field was found at Prudhoe Bay, and three years later, the Alaska Native Claims Settlement Act was negotiated, which set up the creation of the trans-Alaska pipeline. The U.S. government gave 44 million acres (18 million hectares) and \$962.5 million to the indigenous people.

In return, the native Alaskans forfeited their rights to make aboriginal land claims. Thirteen regional and



*A glacier in Alaska's Prince William Sound, where oil transport continues to endanger the natural habitat.*

around 200 village corporations have thus invested in oil drilling and other Alaskan industries. All of the native Alaskans are individual shareholders in these companies.

The pipeline from Prudhoe Bay to Valdez was constructed in the mid-1970s and resulted in incredible population increases to Fairbanks and Valdez. In the 2000s, oil money accounts for almost 80 percent of the state budget, and Alaska has become the United States' largest oil-producing state. The money from the oil business has improved education, transportation, medical care, and communications.

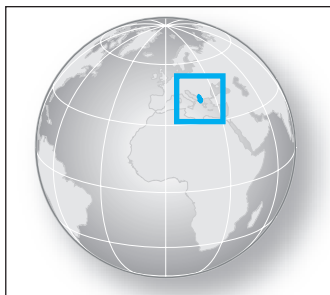
Overall, Alaska has the highest average household income in the country. However, the effects of oil production continues to be debated across the state, especially after the *Exxon Valdez* oil spill, which affected Prince William Sound in 1989. This catastrophic oil spill of 10 million gallons damaged the ecosystem throughout the polluted area. In the early 2000s, debate centered on whether oil drilling should be conducted in the Arctic National Wildlife Refuge in the remote northeast corner of Alaska.

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## Albania

**Map Page** 1133 **Area** 10,685 square mi (28,748 square km) **Capital** Tirana **Population** 3,582,205 **Highest Point** Maja e Korabit 9,085 ft (2,753 m) **Lowest Point** 0 m **GDP per capita** \$4,500 **Primary Natural Resources** petroleum, hydropower.



ALBANIA IS UNIQUE in many ways. This small, mountainous nation on the western side of the Balkan Peninsula has a language and a culture that differ significantly from those of its neighbors. Most notably, it

is the only country in Europe with a majority Muslim population. Albania has been isolated from the outside world for most of its history, at first because of the physical inaccessibility of its terrain and later because of 500 years of occupation by the OTTOMAN EMPIRE.

### ISOLATION

Even during the period of communist rule after World War II, Albanian leaders pursued their own individual course in spite of pressure from its larger neighbors in Yugoslavia and the Soviet Union, resulting in one of the most isolated nations in the world—politically, economically, and culturally. Since reforms began in 1990, Albania has struggled to catch up to the rest of Europe, lagging far behind in political and economic development.

Almost all of Albania is mountainous, from the southern reaches of the Dinaric Alps in the north to the various smaller ranges to the east and south. These ranges form Albania's borders: SERBIA AND MONTENEGRO to the north, MACEDONIA (Former Yugoslav Republic of Macedonia) to the east, and GREECE to the south. Many Albanians live across these borders, however, principally in the province of Kosovo to the northeast, but also in Macedonia and Greece. The numbers of Albanians living in these regions is frequently debated and is the cause of regional tensions, as Albanians seek to find a unified voice for themselves throughout the Balkans.

The narrow coastal plain along the ADRIATIC SEA is the site of Albania's limited agricultural output, raising products suitable to a warm Mediterranean climate: citrus, figs, grapes, olives. The plain is watered by Albania's major rivers, the Drin, Ersenn, and Semani. Higher elevations are suitable for growing wheat and for tending sheep and goats. The mountains also contain mineral wealth, but Albania lacks the resources to extract them profitably. Where the mountains meet this plain is where most of Albania's larger towns are located, including the capital, Tirana, at the foot of the Dajti Mountains. The other major cities are Shkodra in the far north, Durrës on the coast, and Vlora in the far south, where the mountains come right down to the sea. These latter three cities, long important for trade in the Adriatic, were Venetian merchant republics for much of their history, reflected in their historic names, Scutari, Durazzo, and Valona.

Today, most Italian influences are gone, and these cities are repopulated with ethnic Albanians, a people whose origins are unclear, but who are believed to be the region's oldest inhabitants, predating the neighbor-

ing Slavic peoples by several centuries. Their language is believed to be derived from that of the ancient Illyrians, a people whose kingdoms once dominated the Balkan Peninsula until they were conquered by the Romans in the 1st century B.C.E., then pushed out of much of their original territory by migrating Slavs in the 6th to 8th centuries. A medieval kingdom was resurrected in the 15th century under Albania's principal national hero, Skanderbeg, winning a notable victory over the Ottoman Turks in 1449. But within 40 years, Albania had fallen to the Ottomans and had to wait until 1913 to recover its political independence.

In the meantime, Albania became the only European province of the Ottoman Empire in which the majority of its inhabitants converted to Islam, and Albania contributed significantly to the development of the Ottoman state—several of its sons rose through the ranks to become grand vizier, chief minister of the sultan. After gaining independence, Albania veered from republic to monarchy and back before submitting entirely to the strict socialist regime led for four decades by Enver Hoxha. During this period, Albania's economy was 100 percent nationalized (even personal cars were owned by the state), and diplomatic ties were cut with all of its former allies, Yugoslavia, the Soviet Union, and finally, even CHINA, leaving Hoxha's regime completely isolated.

Since 1992, a new regime and a new constitution have attempted to reverse the mistakes of the past fifty years, but Albania remains the least developed country in Europe, with about half of its population working on small farms and half of its industry shut down. Today, much of the national income derives from remittances sent back from Albanians working abroad, mostly in Greece and ITALY.

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## Aleutian Islands

KNOWN AS THE Catherine Archipelago until 1900, the Aleutian Islands comprise some 150 islands in four



Part of Alaska, the Aleutian Islands are America's northwest frontier, populated by native Aleuts.

groups, which are, in order of proximity to the mainland: the Fox, Andreanof, Rat, and Near Islands. The name probably derives from the Chukchi word *aliat*, meaning "island." Geographically, the islands separate the Bering Sea from the PACIFIC OCEAN. They extend in an arc about 1,600 mi (2,560 km) into the Bering Sea off the west coast of ALASKA, to which they belong politically. Their total area is 6,821 square mi (17,666 square km) and the total population is approximately 12,050.

Geologically, the islands comprise limited sedimentary and metamorphic rocks but are mainly volcanic in origin and are located at the junction between the Pacific and North American tectonic plates. They are characterized by volcanic peaks representing a continuation of the Aleutian range of mainland Alaska. Some volcanic peaks remain active, including Makushin on Unalaska and Shishaldin on Unimak, which are the largest islands in the Fox group.

Climatically, the Aleutians are oceanic, with annual temperatures ranging on average from 30 degrees F (–1 degrees C) in January to 52 degrees F (11 degrees C) in August. There is a 135-day growing season between May and September and annual rainfall is 80 in (2.03 m) with rain occurring all year with abundant fog. The natural vegetation is a mixture of Asian and American species comprising dwarf shrubs with grass-, sedge-,



and herb-rich meadows in the lowlands and mosses, lichens, and alpine herbs in the uplands. Most of the islands are within the Aleutian Biosphere Reserve and Wildlife Refuge, which contains a unique mixture of marine birds and mammals.

The islands were colonized at least 8,000 years ago by hunter-gatherers migrating east from Asia when sea levels were considerably lower than today. The native people, the Ungangans, encountered by European explorers in the 1700s were named Aleuts. In 1741, the first European arrivals were Vitus Bering, a Danish seafarer in Russian employ, and Alexei Chirikov; they captained separate ships and each discovered different islands. Bering was shipwrecked and died on what is now called Bering Island in the adjacent Russian-owned Komandorski Islands.

Thereafter, Siberian fur trappers established bases as Russia extended its influence in North America, leading to the exploitation of the Aleuts for labor and the large seal and otter populations for furs. That ended with the transfer of Alaska to the United States in 1867. Further development came with the discovery of gold in Nome in 1900 and the establishment of Dutch Harbor, Unalaska, as a shipping port.

### JAPANESE OCCUPATION

During World War II, the Aleutian Islands featured in hostilities between the United States and Japan. A naval base was constructed at Dutch Harbor in 1942, and following its bombing, the Japanese occupied several islands but were routed in 1943 by U.S. forces from bases on other islands. Underground nuclear tests were carried out on Amchitka (Rat group) in the 1960s and early warning radar systems, pointing toward Soviet Russia, were constructed during the height of the Cold War.

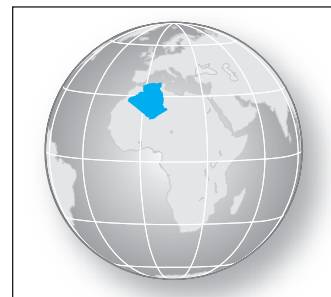
Today, sheep and reindeer herding are part of the economy, with some production of market garden commodities. Hunter-gatherer traditions involving hunting and fishing equipment, including basketry, are maintained by modern-day Aleuts. Fishing and hunting of seal are overseen by the federal government and only Aleuts are allowed to undertake such activities.

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## Algeria

**Map Page** 1113 **Area** 1,479,945 square mi (2,381,740 square km) **Population** 32,277,942 **Capital** Algiers **Highest Point** 9,852 ft (3,003 m) **Lowest Point** -131 ft (-40 m) **GDP per capita** \$5,600 **Primary Natural Resources** petroleum and natural gas, mining.



WITH MORE THAN 80 percent of its land covered by the SAHARA DESERT in northern Africa, Algeria is a country with a history of trade, faith, and conflict. Bordered to the north by the MEDITERRANEAN SEA, Algeria lies between MOROCCO to the west and TUNISIA to the east. Occupying a geographic area of 919,595 square mi (2,381,740 square km), Algeria is the second-largest country in Africa, after SUDAN.

Dominated by the Sahara, Algeria is mostly high plateau with some mountains and a narrow coastal plain along the Mediterranean that has played a major role in the region's history. Strategic Roman outposts dotted Algeria's coast until Emperor Trajan (19–117 C.E.) spread his legions building distant desert cities like Thamugadi (Timgad) and Cuicul (Djemila); these imposing ruins still stand amid sand dunes and oil rigs. However, commanding these Roman settlements was not easy: Native Berber resistance to their presence was constant.

Algeria's Roman cities not only secured Roman involvement in the regional political theater, but also produced some of the Mediterranean's most distinguished personalities, including Saint Augustine of Hippo (354–430), one of Christianity's most notable theologians. Later besieged by Vandals in 429, followed by Byzantine troops 100 years later, Algeria has been a battlefield for citizenry against intruders for more than 2,000 years.

### POPULATION GEOGRAPHY

Algeria's earliest inhabitants were Berbers who remained in the mountainous regions through Roman, Vandal, and Byzantine raids and colonization. Even during Arab expansion and the spread of Islam during the 7th century, the Berbers managed to stay distant, preserving much of their culture, and to this day they represent 30 percent of Algeria's population and a growing voice throughout the country. After Arab, Ottoman Turk, and Spanish influence, the French con-

quered Algeria in 1830. This protectorate of France endured cultural concession, oppression and compromise until the struggle for independence began in 1954. Fomented by the National Liberation Front (FLN), Algeria gained its political freedom eight long years later in 1962.

Since the late 1980s, Algerian politics have been managed by a discomfiting antagonism between military and Islamic militants. In 1992, a victory by the Islamist Party was rescinded, setting off bloodshed that killed thousands of citizens. Only after national amnesty was declared were the weapons laid down on both sides.

After political instability and the natural death of President Boumediene in 1980, his closest friend and minister of foreign affairs, Abedlaziz Bouteflika, was forced into exile, only to return eight years later to work with the FLN Congress. In 1999, he was elected president and reelected in 2004. In 2002, after months of unrest among the Berber communities, the government recognized Berber as an official language, shaping a new focus on its unique culture and history.

Though the country is nearly 10 times the size of CALIFORNIA, Algeria's narrow Mediterranean coast is today home to most of the activity: cities, farms, ports, and highways. With a lucrative export trade overshadowing its low import levels, Algeria's industrial sector has been strong since oil was discovered in 1956. Algeria's extensive supplies now rank worldwide as fifth in gas reserves and 14th in oil, which have dramatically increased the gross domestic product. Oil and gas wells are primarily located inland, with an extensive pipeline network feeding the ports of Arzew and Skikda. Petroleum, petrochemicals, and natural gas are Algeria's largest exports.

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## alluvial fan

THE U.S. COMMITTEE on Alluvial Fan Flooding recently defined an alluvial fan as “a sedimentary deposit located at a topographic break, such as the base of a

mountain, escarpment, or valley side, that is composed of streamflow and/or debris flow sediments and that has the shape of a fan either fully or partially extended.”

The fanned or delta shape of alluvial deposits from mountains is formed over many thousands of years by downward-flowing waters or mud leaving the confines of their channel and spreading out into a wider area. The increase in the width of flow causes a decrease in the depth and velocity of the rushing water, which allows the deposition of sediment. This sediment consists of sand, debris, clay, and gravel carried by the stream or river from higher elevations, which can spread over hundreds of miles or kilometers.

Erosion also plays a part in alluvial fan formation, as newer flows carry away or redistribute material deposited earlier. Fans that sit inactive through climate changes and tectonic activity over many centuries are also subject to weathering and wind erosion. Alluvial fans are built unevenly; varying amounts and size of debris, volume of water, and placement of previous deposits influence where the alluvium is left. Usually, the larger rocks are closest to the topographic break, while finer grains travel further before being deposited. Some areas of the fan build up more sediment than others over years. Overall, the slope of a fan is commonly under 10 degrees. A flash flood leaves a different pattern of deposits than a shallower and less violent stream of water. Alluvial fans can consist of evenly dropped sand or be riddled with channels and trenches of varying depths. The former is considered more dangerous, because the lack of paths for water makes predicting the pattern of future floods impossible.

Alluvial fans are most often found at the base of hills and mountains in arid or desert environments or piedmont plains all over the world. They are very common in western North America; in PAKISTAN, IRAN, and other parts of the MIDDLE EAST; Europe, especially in SPAIN and ITALY; and the Andean areas of CHILE and ARGENTINA. They form where highlands border lowlands, and where the lowland basin area is smaller than the highland area. Often in mountainous terrain, two or more alluvial fans merge or cross each other. This forms a feature called a bajada or bahada, which extends into a flood plain. Like an alluvial fan, bajadas tend to be built of larger rocks and sediment near the mountains and channels that guide water to them, while finer silts mark their edges.

In the UNITED STATES, the Federal Emergency Management Agency (FEMA) can designate certain areas as natural hazards. After several catastrophic floods in



the late 1970s, FEMA began to evaluate the risks of flooding to alluvial fans. Some fans that were still subject to flooding presented attractive, gentle slopes for commercial or residential development. FEMA now decides whether such sites are hazardous based upon how susceptible they are to alluvial flooding and flood occurrence over a 100-year cycle, and how predictable the course of the floods will be.

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## alluvium

THE SEDIMENT DEPOSITED by rivers is called alluvium. The name derives from the Latin word *alluvius*, meaning "washed up." Alluvium comprises clay, silt and sand (in some definitions gravel is included) and derives from the erosion of rocks and soils in the upper reaches of river basins. The mineral characteristics of the alluvium thus reflect its origins. It is carried downstream until the energy or sediment-carrying capacity of the river diminishes and the water can no longer carry the sediment in suspension.

During carriage, the sediment may be altered in physical character because of sorting and attrition. Sorting involves the separation of particles on the basis of size with finer and thus less dense particles like clay being carried farther downstream than larger and coarser particles such as sand and gravel. Attrition occurs as sediment particles collide during transport; overall, this causes a reduction in particle size and a general rounding in shape as angular material is smoothed.

The deposition of alluvium in river channels, on floodplains, in estuaries, deltas, and lakes takes place over time. The erosional, depositional, and attritional regimes of a river may also change over time depending

on climate and land-use characteristics in the river catchment.

Alluvium is widespread globally. It may provide fertile agricultural land because it is rich in nutrients, and it has provided the means for some of the world's great civilizations to develop and thrive. Examples include those of ancient EGYPT based on the NILE Valley, those of the Indus civilization in the valley of the same name, and those of ancient Mesopotamia in the Tigris and Euphrates Valleys. Today, some of the world's most productive agricultural land is on alluvium, as are many of the world's major urban areas, for example, LONDON, Bangkok, BUENOS AIRES, Cairo, MUMBAI (Bombay), and Shanghai. In many cases, there is conflict of interest in relation to land use as urban spread competes with agriculture and sediment extraction, such is the value and prized location of alluvial deposits.

Where alluvium comprises the fine particles of clay, it can be used for brick making and pottery, and where gravel predominates, it is sometimes excavated for use as road aggregate and building materials. If ore-bearing rocks occur in the upper catchment of a river, the alluvium resulting from their erosion may be sufficiently mineral rich to warrant extraction. The most important metallic minerals found in alluvium include tin, gold, and platinum. Precious stones such as diamonds may also be found if catchment rocks are a source of gem stones.

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## Alps

THE ALPS ARE Europe's major mountain chain, occupying center stage between the cultural and geographic regions of western, eastern, southern, and northern Europe. Stretching in an arc about 600 mi (1,000 km) from west to east, the range covers parts of FRANCE, ITALY, SWITZERLAND, LIECHTENSTEIN, AUSTRIA, and SLOVENIA, with related features extending into GERMANY, CROATIA, and BOSNIA. Geologically, the mountains are at the core of even wider-reaching mountain systems, such as the Apennines and the Carpathians,



Once remote with practically impenetrable borders owing to the high mountains, Switzerland and parts of other countries within the Alps ranges are now more accessible with the construction of major mountain passes and tunnels.

and several lower chains on the outskirts (considered pre-Alps) such as the Jura in France, the Schwäbische Alb in Germany, or the Wienerwald in Austria—all were formed as a result of the collision of Italy and the Mediterranean floor with the landmass of Europe 150 million years ago. Several million people live within sight of the Alps, including residents of such major cities as Turin, Vienna, and Grenoble. The mountains—sometimes referred to as the “backbone” of Europe—have played a significant role in the history of Europe. Presently, the Alps are among the leading tourism locales in Europe, with about 100 million visitors per year, leading to challenges in growth such as overdevelopment and air pollution.

The origin of the name *Alps* is uncertain; it is most likely Celtic, perhaps for “white” or “high.” For many centuries the range was seen as a barrier between Mediterranean civilization and northern Europe, marked by heroic crossings like that of Hannibal with his elephants in 218 B.C.E. Mountain cultures in Switzerland, the Tirol, and southeastern France typi-

cally represented independence from authority and dogged defense of traditional freedoms, from William Tell to the perpetually neutral Swiss state of today. Gradually, the mountains were explored and valleys were settled. From the development of climbing as a sport in the 19th century and the engineering marvels of lengthy tunnels of the 20th century, the Alps ceased to be a threatening impasse, a land of avalanches and evil spirits, and became a recreation spot instead, a place of beauty. Notable sporting centers include Winter Olympic sites at Grenoble, Chamonix, Albertville, Garmisch, Innsbruck, and Cortina and ski complexes as Zermatt, Saint Moritz, and Bad Gastein.

There are numerous peaks over 12,000 ft (3,500 m), more than 1,200 glaciers, high carved-out circular basins called cirques, and sharp crags known as aiguilles. Long, narrow valleys separate high peaks, creating dramatic views, often accentuated by large, elongated lakes. These lakes are relics of the last Ice Age when glaciers dug deep trenches between the ranges: Lakes Maggiore and Como in Italy, Lakes

Geneva, Neuchâtel and Constance in Switzerland, and the series of interconnected lakes in central Switzerland are all generally long and very deep rather than wide. Other valleys were cut by swift mountain streams that form some of Europe's major rivers: the RHÔNE, the RHINE, the Po, and several major tributaries of the DANUBE, the Inn, the Mur, the Drava, and the Sava. These rivers carry water from the Alps as far away as the MEDITERRANEAN, North, and BLACK seas.

The Alps are traditionally divided into three sections, Western, Central, and Eastern, with numerous subdivisions within these. The border between France and Italy is delineated by the Maritime Alps, with peaks that emerge almost directly from the Mediterranean Sea, followed by the Cottian, Graian and Dauphiné (or Delphinic) Alps, and the Mont Blanc complex. Gran Paradiso, in the Graians, is the tallest peak entirely within Italy (13,648 ft or 4,061 m). Directly to the north is the double summit of Mont Blanc (15,771 ft or 4,806 m), the highest mountain in Europe outside of the Caucasus. The Mont Blanc massif is composed of several peaks and includes one of the longest vertical slopes in Europe (over 11,550 ft or 3,500 m), and the largest glacier in France, the Mer de Glace ("sea of ice") on the Col du Géant. A 7-mi (11-km) tunnel directly beneath the mountain connects ski resorts in France and Italy.

After traveling mostly northward from the Mediterranean, the Alpine chain turns a corner at the Mont Blanc group. Heading eastward, the mountains of the Central Alps form some of the highest and most famous portions of the Alps. Directly east of Mont Blanc, separating it from the Pennine Alps, is the Great Saint Bernard Pass, one of the highest passes in Europe and the site of a monastic hospice for travelers for nearly 2,000 years. The Pennines, forming the border of Switzerland and Italy, together with the parallel range of the Bernese Oberland to the north, form the quintessential Alps of postcard quality. Mountains such as the Matterhorn and the Jungfrau are immediately evocative of the Alps and Switzerland. The Pennine Alps contain 10 of the 12 highest peaks in the Alps. The Aletsch glacier is the largest in Europe, 16 mi (26 km) long, covering 50 square mi (130 square km). The Central Alps also include the mountains of southeastern Switzerland, the Lepontine, Bernina, Glarner, and Rhaetian Alps.

The Eastern Alps begin roughly at the watershed between the Rhine and Danube river basins. These chains tend to be less orderly in their organization, but continue to be more or less aligned in an east-west di-

rection. The Austrian Alps include the Bavarian range on the border with Germany (including Germany's highest peak, the Zugspitze, at 9,718 ft or 2,963 m, the Ötztal and Ortler ranges on the border with Italy, and the Höhe Tauern, with Austria's highest mountain, the Grossglockner (12,461 ft or 3,797 m). To the south, the Italian Dolomites have a slightly different character, with more rocks and less snow. Along Austria's southern frontier with Italy and Slovenia run the Carnic Alps, the easternmost part of the Alps proper. The Julian Alps are an offshoot to the south across Slovenia, with links to the lengthy mountain chain that runs down the length of the Adriatic coast, the Dinaric Alps.

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## Altai Mountains

THE ALTAI MOUNTAINS are a system of remote mountains in central Asia that cover an area of 326,256 square mi (845,000 square km) bounding RUSSIA, KAZAKHSTAN, MONGOLIA, and CHINA. This system is a natural marvel that has been largely untouched by large industries and has a very sparse population. Its name is derived from the Mongolian word *altan*, which means "golden." This region is home to many species of wildlife and plants and is made up of various landscapes. Most of the population in this region relies on farming and tourism.

The mountains stretch for 1,242 mi (2,000 km) from northwest to southeast, reaching a height of about 14,783 ft (4,506 m) at Belukha. Many rivers can be found in the Altai Mountains and most of them are fed by glaciers. Some of the largest rivers are Katun, Biya, and Chuya.

The glaciers cover an area of about 900 square mi (2,330 square km). Together with intensive river erosions, they have contributed significantly to the creation of the ruggedness of the region, where high waterfalls, steppes, and thousands of lakes can also be found. The deepest lake in the Altai Mountains, Telet-



skoe, is 1,066 ft (325 m) deep. The Altai Mountains are the source of the Ob and Irtysh Rivers, two of the major rivers in Asia. The region is rich in many natural resources like iron, gold, mercury, manganese, and marble. The United Nations Educational, Scientific and Cultural Organization (UNESCO) recognized the importance in preserving this eco-region and added five clusters of the Altai in the World Natural Heritage List.

The region is characterized by a continental climate with long, cold winters and short, cool summers. Snow starts covering the mountains during October and November, marking the beginning of winter. Temperatures hit the lowest in January, where they can range from 7 degrees F (-14 degrees C) in the foothills to -76 degrees F (-60 degrees C) in the STEPPES. In northern Siberia, one can find vast areas of permanently frozen soil. Summers begin somewhere between May and July and end in September. During this time temperatures often reach 75 degrees F (24 degrees C) during the day. Temperatures of 104 degrees F (40 degrees C) have also been recorded in the lower regions. At night, temperatures get cooler, usually ranging from 41 degrees F (5 degrees C) to 50 degrees F (10 degrees C). Elevations of 5,000 to 65,000 ft (1,500 to 19,000 m) experience high precipitation, usually ranging from 20 in (50 cm) to 40 in (1 m) a year. One aspect of the summer that many people appreciate is the lack of mosquitoes.

Four vegetation zones can be found in the Altai Mountains: the mountain subdesert, steppe, forest, and the Alpine areas. The most widely used plants and trees are cedar, badan, kuril tea, and cannabis. The subdesert has very little plant life; the few plants that exist are drought-resistant and salt-tolerant. Many sod grasses and shrubs can be found in the steppe. The forest is generally swampy and covers a large area in the low to medium mountain area. Here are found pines, firs, larches, and birch and aspen forests. The meadows in the Alpine region are used for pasture during the summer.

Wildlife is abundant in this region. There are 230 species of small birds, like woodpeckers, and 20 species of fish. Big mammals like bears, lynx, and musk deer are found mostly in the forest. In the Alpine region live reindeer, mountain goats, rams, and even rare animals like snow leopards. Some areas in the mountains are inaccessible to locals and visitors because they are used to study rare species of animals and plants.

The Altai Mountains are populated by mostly Altai and Russian settlers, many of whom moved there in the 19th century, mainly to escape religious persecu-

tion. The native population that was there before the 19th century continues to live in the old ways and is somewhat isolated from civilization. This area faces many challenges, especially with civilization knocking on its door. The big question is how to preserve the ecosystem and its natural beauty in spite of the increasing number of tourists and developments.

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## Altiplano

THE ALTIPLANO IS A high plateau located in the central ANDES region of South America at an altitude of about 13,123 ft (4,000 m). It reaches into parts of PERU, BOLIVIA, CHILE, and ARGENTINA. On the west, it bounds the Cordillera Occidental and borders the Cordillera Oriental on the east. It is surrounded by volcanoes reaching altitudes of 19,685 ft (6,000 m), whose activities have caused landfalls that are responsible for the reshaping of this large plateau. The Altiplano has an area of 105,633 square mi (170,000 square km) that is volcanic in origin.

Lake TITICACA is the lowest point of the Altiplano, and occupies its northern basin. It is located at an altitude of 12,500 ft (3,810 m). It has an area of 5,632 square mi (14,587 square km) and reaches depths of 1,214 ft (370 m), making it the highest navigable body of water on earth. The large volume of water makes it possible for the lake to retain a stable 50 degrees F (10 degrees C) temperature. The lake plays an important part in affecting the surrounding climate. The southern basin of the Altiplano is occupied by shallow salt lakes and flats. Lake Titicaca drains into Lake Poopo through the Desaguadero River. Lake Poopo, which is a shallow saltwater lake whose depth rarely reaches more than 13 ft (4 m), is dependent on the flow of water from Lake Titicaca and seasonal rainfall. One of the largest salt flats in the Altiplano is the Uyuni Salt-

pan. It is all that remains of an ancient lake that covered an area of 5,592 square mi (14,483 square km). Today, this saltpan is filled with salt, which can be as deep as 16 ft (5 m).

The Altiplano's climate is characterized by a long dry season, lasting from April to November, and a short wet season. The wet season is from November to March, when 95 percent of the rainfall occurs. The amount of rain decreases from northeast to southwest. This is possible since a rain shadow effect is created that allows the northeast to receive more water. The Cordillera Oriental, for example, receives about 51 in (130 cm) of water annually, while the southern Altiplano receives only 6 in (15 cm). The atmosphere here is more transparent to radiation because of the greenhouse effect. This causes an increase in nighttime heat loss, which is noticeably greater than the rate at sea level. The ultraviolet radiation is 20 percent greater in the Altiplano than the radiation at sea level.

The highest temperatures during the summer are measured in late November, reaching 68 degrees F (20 degrees C) during daytime and falling to near 5 degrees F (-15 degrees C) at night. During the winter, June to August, mean temperatures reach as high as 55 degrees F (13 degrees C) and fall to 12 degrees F (-11 degrees C) at night. Strong winds are common in the Altiplano, reaching 62 mi per hour (97 km per hour). They are present nearly every day and are usually stronger in the afternoon.

The Altiplano ecosystem has a dry STEPPE climate, predominated by grasses. The lack of oxygen in the high altitudes of the Altiplano allows only a few plants and animals to survive. Some of the animals living in the region are condors, flamingos, different species of cameloids (e.g., American camels), llamas, alpacas, and many bird species. The Altiplano is also home to the quinoa tree, which grows at an elevation of over 11,500 ft (3,500 m).

The Altiplano has been home to the Inca peoples. Today, some of its areas are populated by Aymara natives. Since the Inca's time, the plateau has seen much mining: Gold and silver are two of the metals sought by miners and mining companies. Other natural resources include tin, natural gas, petroleum, zinc, tungsten, antimony, silver, iron, and lead. Mining has been the source of pollution to the air, water, and soil in the Altiplano.

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## Amazon Rainforest

THE AMAZON RAINFOREST is the largest rainforest in the world. It extends for 3,000 mi (4,828 km) from the ANDES mountains to the ATLANTIC OCEAN. The rainforest covers parts of BRAZIL, PERU, ECUADOR, COLOMBIA, BOLIVIA, and VENEZUELA, encompassing over a billion acres and covering one-third of South America. The 6,500 mi (10,461 km) of the great AMAZON RIVER, second only to the NILE RIVER in length, flows throughout the rainforest. Eleven hundred tributaries, some of which are over 1,000 mi (1,609 km) long, feed into the Amazon River.

Since the rainforest is close to the equator, its CLIMATE is hot and humid at all times. From 40 to 80 in (100 cm to 200 cm) of rain falls annually in the eastern section of the rainforest, while the western region experiences around 160 in (400 cm) of rain each year. THUNDERSTORMS occur more than 200 days of the year. In sections of the rainforest that are closest to the equator, rain falls almost constantly. Trees within the rainforest are always green, but many shed their leaves in response to biological and climatological changes.

The Amazon Rainforest is considered a resource for the entire world, in part because of the plant life that protects the world's environment from the greenhouse effect. When the rainforest performs its natural function, at least 50 percent of the rain returns to the atmosphere on the leaves of trees through the process of evapotranspiration. This process uses the water loss from the trees in the rainforest to form clouds that make rain in other, more protected parts of the rainforest area.

The rainforest is made up of four layers: the emergent layer, the canopy, the understory, and the forest floor. The emergent layer is located at the top of the trees of the rainforest. This layer is subject to intensive amounts of sunlight, high temperatures, low humidity, and strong winds. The canopy, sometimes called the upper canopy, is made up of the tallest trees in the forest. These trees, which may grow to 200 ft (61 m), pro-

tect the land below from harsh sunlight. The middle layer of the rainforest, known as the understory or lower canopy, may be as high as 20 ft (6 m). It is made up of various small trees, vines, and shrubs. The forest floor or the jungle is composed of ground cover such as herbs, mosses, and fungi. The wildlife in this section of the rainforest eats roots, seeds, leaves, fruit, and smaller animals.

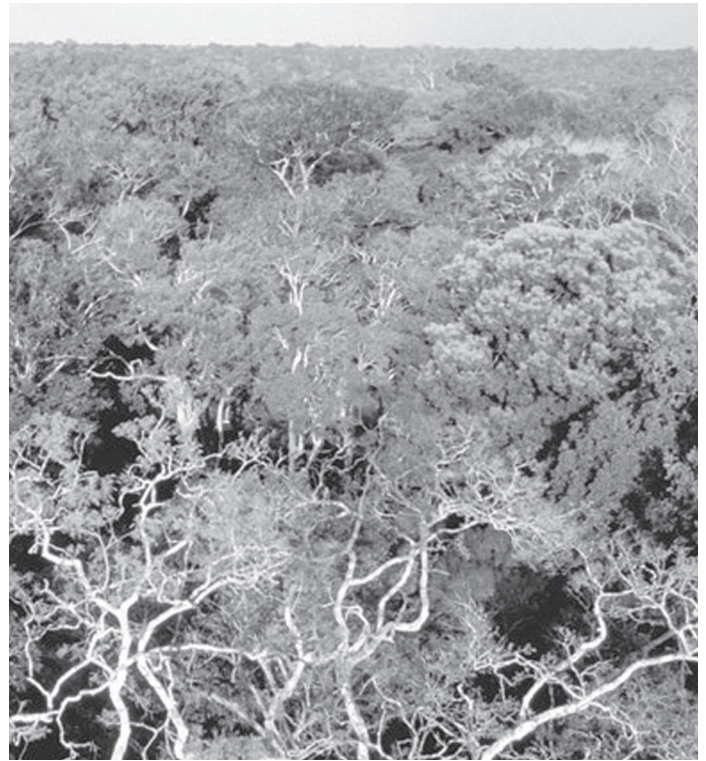
Around two-thirds of all animals and plants in the rainforest inhabit the canopy. For instance, in a section of a canopy in the Peruvian rainforest, scientists identified over 50 species of ants, 1,000 species of beetles, some 1,799 arthropod species, and approximately 100,000 species of fauna. Samples taken from canopies in PANAMA, Brazil, Peru, and Bolivia revealed over 1,500 species of beetles in each canopy. Because the canopy area is not easily accessed and because many insects find shelter underneath the leaves, it is thought that thousands of species may yet be discovered. Some species of wildlife spend their entire lives in the trees of the rainforest.

Poverty, population growth, greed, and shortsightedness have historically been the major threats to the Amazon Rainforest. Construction, which often operates on the principle of “slash and burn,” has created a new threat since the middle of the 20th century. For instance, in February 2001, officials in Ecuador contracted with an international consortium to construct the 300-mi (483-km) Oleoducto de Crudos Pesados (Heavy Crude Pipeline) intended to transport crude oil from the rainforest to the Pacific Coast, affecting forests and wildlife and displacing native inhabitants.

### RAINFOREST SOILS

Three major soil types have been identified within the Amazon Rainforest. One layer, known as ultisols, is made up of kaolinite clay and minerals that are transported from flooded upper soil levels. This acidic soil, containing aluminum compounds, is not conducive to plant life.

A second layer, called oxisols, which is made up solely of kaolinite clay, is thick and sticky and virtually unusable to plants. Spodosol soils, which are found in higher lands that are not subject to flooding, tend to be sandy and acidic and are incapable of retaining nutrients. Soils in the rainforest are generally unable to absorb water, further contributing to the difficulties that local farmers face. On the other hand, soils within wetter parts of the rainforest provide an excellent growing area for exotic tropical plants, many of which serve as food for animals in the rainforest.



*Many animals live in the busy canopy or treetop layer of the Amazon Rainforest shown above.*

### FAUNA AND FLORA

Around 80 percent of all food eaten by the people of the world today originated in the tropical rainforests, including over 3,000 species of fruit. Edible produce from the Amazon Rainforest include: Brazil nut, cashew, banana, fig, coffee, cocoa, vanilla, passion flower, breadfruit, yucca, avocado, coconut, orange, lemon, grapefruit, guava, pineapple, mango, tomato, corn, tomato, potato, rice, winter squash, yam, black pepper, cayenne pepper, chocolate, soybean, cinnamon, clove, ginger, sugarcane, tumeric, and coffee. Orchid, philodendron, bamboo, mahogany, and rubber fungus are also found in the rainforest.

More animals and plants are found within the Amazon Rainforest than in the rest of the world combined. At least 500 species of mammals, 175 varieties of lizards, 300 species of other reptiles, and innumerable species of tree climbers are among the many animals identified so far. Scientists and environmentalists believe that there are thousands of species of wildlife in the rainforest that have yet to be identified. Some of the animals found in the rainforest include anaconda, ant, anteater, beetle, boa constrictor, pit viper, butterfly, katydid, piranha, capybara, caiman, coatimundi,





*The Amazon Rainforest is perhaps the largest resource in the world, referred to as the “lungs of the planet.”*

kinkajou, puma, tarantula, tree frog, moth, tapir, cockroach, iguana, jaguar, cougar, deer, lemur, orangutan, marmoset, pink dolphin, wild dog, wolf, raccoon, otter, ocelot, three-toed sloth, mosquito, bot fly, bat, and termite.

One-third of the world's birds reside in the Amazon rainforest, including the macaw, parrot, toucan, harpy eagle, crow, ant bird, and umbrella bird. Approximately one-fifth of all freshwater fish are found in the Amazon Basin. Unfortunately, a number of unscrupulous individuals have engaged in illegal wildlife trading, decreasing the number of animals found within the rainforest and further threatening the natural balance of life there.

## PEOPLE

Gonzalo and Francisco de Orellana, two Spanish explorers, discovered the Amazon River region in 1541 while looking for valuable minerals and spices. They encountered native people, including a band of women warriors who became known as Amazons. Many of the native people died from diseases brought by explorers to the New World or from being enslaved. Whole tribes were wiped out. In the 16th century, over 10 mil-

lion natives resided in the Amazon Rainforest. That number had decreased to less than 200,000 by the beginning of the 21st century.

In Brazil, for example, only 10 percent of the original tribes remain. Some of the poorer members of the tribes that inhabit the Amazon Rainforest today survive on subsistence farming, further destroying valuable resources. Natives within the rainforest eat cassava, yucca, fruits, nuts, fish, insects, and animals such as rabbits, deer, and wild pigs that they shoot with rifles or blowguns. Some tribes, such as the Kayapó, have become more Westernized, enjoying bank and money market accounts, airplanes, tractors, bulldozers, and other luxuries of modern life.

## RAINFOREST DESTRUCTION

James Alcock, a professor at Pennsylvania State University, has estimated that at the current rate of destruction, the point of no return in the Amazon Rainforest could be reached as early as 2016. Unchecked destruction could entirely wipe out the rainforest by the middle of the 21st century. Poverty, population growth, greed, and shortsightedness have historically been the major threats to the Amazon forests. Construction, which often operates on the principle of “slash and burn,” has posed a serious threat since the middle of the 20th century. Much of the Amazon Rainforest was destroyed by João Baptista Figueiredo, the president of Brazil who built the Trans-Amazonian Highway, destroying vast tracts of the forest in western Brazil. This highway provided a means for loggers, ranchers, builders, prospectors, and a variety of other people and businesses from around the world to flock to the rainforests, speeding up its destruction. Fire has also become a major threat in recent years as the rainforest has become drier. The fragile lands of the rainforest are also being used for cattle grazing and subsistence farming. The worst period of destruction in the rainforest came between 1978 and 1990 before the destruction of the rainforest became widely known.

Francisco Alves “Chico” Mendes Filho, a Brazilian rubber tapper, union organizer, and ecologist, became the voice of those who were determined to educate the world about the Amazon Rainforest. Mendes was instrumental in the foundation of the National Council of the Seringueiros and helped to plan the extraction reserves, which created government-owned conservation areas designed to give rainforest natives control over the production and protection of the Amazon Rainforest. Mendes was murdered on December 22,

1988, in the doorway of his home. Through the efforts of the Chico Mendes Committee, Darly and Darcy Alves de Silva were charged with his murder. Mendes's death galvanized the conservationists and enhanced their efforts to protect the rainforest.

Some scientists believe that as much as 30 acres of rainforest are being destroyed every minute in the rainforests of the world. As acre after acre of rainforest is being destroyed, nature's natural shield is disappearing, since there are fewer trees to use the carbon dioxide as food through a process called photosynthesis. As a result, levels of carbon dioxide in the atmosphere are increasing every year.

Intrusions into the rainforests have also destroyed valuable resources such as medicinal plants, quinine, muscle relaxers, steroids, and various cancer-fighting drugs. Seventy percent of the 3,000 drugs with cancer-fighting properties that have been identified by the U.S. Cancer Institute are found in the Amazon Rainforest. American drug companies are so convinced of the potential for finding further disease-fighting drugs in the rainforest that some 100 companies have funded projects to study the plants used by native inhabitants of the rainforest for thousands of years.

One third of the Amazon Rainforest is located in Brazil, where authorities believe that as much as 80 percent of all logging done in the rainforest is done illegally. In 2003, authorities launched a satellite system designed to prevent illegal logging in the rainforest. Brazil has also begun to levy fines against multinational corporations that engage in illegal logging.

Peru has been losing approximately 716,000 acres (289,755 hectares) of rainforest a year. In March 1992, the nonprofit Amazon Center for Environmental Education and Research Foundation (ACEER) opened the Amazon Biosphere Preserve in Peru to increase knowledge of the Peruvian rainforest and to provide protection for this fragile resource. One way that ACEER has done this is through the erection of a canopy walkway project that allows greater access for scientists to study the living matter that resides in the rainforest. The walkway also provides tourists with a firsthand look at the mysteries of the Peruvian rainforest. ACEER's facilities include also bird and butterfly preserves.

Ecuador has been much more remiss than either Brazil or Peru in protecting its section of the Amazon Rainforest. Ecuadorian authorities have permitted logging, road construction, and oil exploration to destroy approximately 466,800 acres (188,907 hectares) of rainforest a year. In February 2001, officials in Ecuador contracted with an international consortium

to construct the Oleoducto de Crudos Pesados (Heavy Crude Pipeline) intended to transport crude oil from the rainforest to the Pacific Coast, destroying forests and wildlife and displacing native inhabitants. As a result, only 1 percent of Ecuador's rainforest has survived.

The rainforest in Colombia is host to over 1,815 species of birds, 590 species of amphibians, and 3,200 species of fish. Like Ecuador, Colombia has done little to check the problems caused by illegal logging, mining, pollution, agriculture, and illegal animal piracy. Similarly, Bolivia has done little to stop multinational logging companies and cocoa and soybean farmers from destroying much of its section of the Amazon Rainforest.

Venezuela has had the additional problem of dealing with oil exploration within its region of the rainforest. Big oil companies destroyed much of Venezuela's forests before 1974, when authorities nationalized the oil industry. Belatedly, the Venezuelan government created a number of national parks and passed protective legislation and recognized the rights of native inhabitants of the rainforest.

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## Amazon River

SOME AUTHORITIES believe that the river in BRAZIL and neighboring countries was named after the Amazons, women warriors of Greek mythology, who were thought to reside in the region; other scholars insist that the name is derived from the local native word



*The Amazon River basin covers a good portion of Brazil, Bolivia, Peru, and Colombia in South America.*

*amassona*, meaning “boat destroyer.” Despite centuries of effort to overcome the dominance of nature, people have made little impact on the Amazon and most of its vast drainage basin. No bridge spans the river. Except near its mouth, the Amazon watershed constitutes one of the most thinly populated regions in the world. Much of the territory drained by the river system has never been thoroughly explored. One may fly for hours over the tropical forests that cover much of the river’s FLOODPLAIN and see no sign of human settlement. In many valleys, native tribes remain hostile to strangers, continuing to live much as they did before the arrival of the Europeans.

### BASIN GEOGRAPHY

The Amazon Basin is a vast structural depression covering approximately 2,722,000 square mi (7,049,800 square km), an area nearly as large as the continental portion of the UNITED STATES. It is twice as large as the world’s next largest drainage BASIN (the CONGO RIVER), and supports the world’s largest rainforest. Geologi-

cally, two large stable masses of Precambrian rock, the Guyana Shield or Highlands to the north and the Central Brazilian Shield or Plateau to the south, bound the Amazon River and basin. Some 15 million years ago, before the ANDES MOUNTAINS were formed, the Amazon River flowed westward into the PACIFIC OCEAN. With the uplift of the Andes Mountains, however, the course of the river was eventually blocked to the west. As the river system backed up, the environment of the Amazon basin changed and numerous freshwater lakes began to form an inland sea. Ultimately, the gradient and volume of water was sufficient to push the flow to the east toward the ATLANTIC OCEAN where it empties today.

Most sources list the Amazon as 4,080 mi long (6,580 km), making it second to the NILE in length. However, there is some debate about the length of the Amazon versus Nile depending on the actual starting point of the source. According to recent discoveries, the Amazon is 4,195 miles (6,712 km) long if the course follows the Apurimac branch (rather than the Urubamba branch) of the Ucayali to a point 17,200 ft (5,242 m) above sea level, making it 50 mi (80 km) longer than the Nile. The Ucayali and Marañon rivers, both of which rise in the permanent snows and glaciers of the high Andes Mountains, flow along roughly parallel courses to the north before joining near Iquitos, Peru. Beyond Iquitos the river turns abruptly eastward, flowing along a very gentle gradient (approximately 1.25 in or 3.2 cm per mile) more or less paralleling the equator as it meanders over lowland plains. At Manaus, approximately 1,000 mi (1,610 km) upstream from the coast, the elevation is only 100 ft (30 m) higher than Belem, which is an ocean port.

The northern half of the South American continent is shaped like a shallow dish. More than 1,000 tributaries, seven of which are more than 1,000 mi (1,613 km) long, flow through nine South American countries (Brazil, BOLIVIA, PERU, ECUADOR, COLOMBIA, VENEZUELA, GUYANA, SURINAME, and FRENCH GUIANA) that contribute waters to this dish. Beyond the riverbanks there are broad, swampy floodplains covered with lush, periodically flooded forests.

Throughout most of the Brazilian part of the river, the channel exceeds 150 feet (50 m) in depth, although some parts near the mouth have been recorded to be as much as 300 feet (91 m) deep. Discharge at the mouth of the Amazon is approximately 7,733,000 ft cubed per second (219,000 meters cubed per second), nearly five times the volume of the Congo and roughly equal to the volume of all the other major rivers of the world



combined. At some points, the Amazon is 1 mi (1.6 km) wide, while at other points during the flooding season it can be 35 mi (56 km) wide or more. At Belem, where the waters flow into the Atlantic Ocean, it can be 200 to 300 mi (322 to 483 km) across, depending on the season and including the river's influence along the coast.

At Iquitos in Peru, the furthest point up river for major navigation by ship, the river also changes its name. From Iquitos to the junction of the Rio Negro near Manaus the river is known locally as the Solimoes, while from Manaus to the sea it is referred to as the Amazon.

## CLIMATE

Over most of this vast region the CLIMATE is very warm and humid. Rain falls about 200 days each year, and rainfall totals often exceed 80 in (204 cm) per year. One result of so much rain is that the Amazon is subject to seasonal floods. Tributaries flowing from the south tend to flood from February to April, while those coming from the north reach flood peaks between June and July. As these waters make their way to the sea, the waters of the Amazon vary in color depending on the soils and rocks they pass over. Some of the tributaries are home to "white" waters, although their color is more often a murky yellow or tan than white. The white rivers originate from runoff in the Andes, and their turbidity results from the heavy loads of mud and silt they carry.

Waters in so-called black rivers, on the other hand, come from areas where the water flows over ancient rocks where there is little sediment remaining to be washed away. The black rivers are dark because only dissolved organic matter stains their clarity. Clearly the most dramatic union of black waters with white occurs at Manaus, where the black waters of the Rio Negro and the ochre-tinted Rio Solimões meet. Locally known as the Encontro das Aguas (Wedding of the Waters), the waters run side by side for miles before they finally mix.

There is some evidence suggesting that the lower Amazon may once have been an ocean gulf, the upper waters of which washed the cliffs near Obidos some 600 miles (966 km) from the coast. The effects of the ocean are still felt at Obidos. Because of the gentle slope of the land, tides are able to penetrate this far upstream. Here the tidal phenomenon called the bore, or Pororoca, occurs. Often up to 12 ft (3.7 m) high, it begins with a roar, constantly increasing as it advances at a rate of from 10 to 15 mi (16 km to 24 km) an hour

Beyond the point where the Zingu River joins the Amazon from the south, the main channel splits into a maze of smaller channels with numerous large islands. Marajo, the biggest island in the delta, is about the size of Vermont and New Hampshire combined. Finally, beyond its several mouths, the Amazon merges with the sea just above the equator where ocean currents bend it northwestward along the coast ultimately becoming part of the South Equatorial Current.

## THE RAINFOREST

The Amazon rainforest, also known as Amazonia, is the largest tropical rainforest in the world, covering more than half of Brazil. It is also one of the world's greatest natural resources, containing the largest single reserve of biological organisms in the world. No one really knows exactly how many different species inhabit the area, but scientists estimate there are between 800,000 and 5 million, amounting to 15 to 30 percent of all the species in the world. Because its vegetation continuously recycles carbon dioxide into oxygen, it is often referred to as the "Lungs of our Planet."

The Amazon Rainforest consists of four layers or communities. Each layer has unique ecosystems, plants, and animals adapted to that system. The emergent layer is the tallest layer, where trees can be as tall as 200 ft (61 m) and rise well above the canopy. Here they are exposed to fluctuation of temperature, wind, and rainfall. The leaves are small and covered with a thick waxy surface to hold water. They take advantage of the wind by developing winged seeds that are blown to other parts of the forest. Trunks can be up to 16 ft (4.9 m) around and braced by massive buttress roots. Some of the animals find everything they need to survive in the emergent layer and never leave it.

The main layer of the rainforest is the canopy. Most canopy trees have smooth, oval leaves that come to a point, known as a drip tip. This allows water to flow off the leaf quickly and prevents the growth of fungi, mosses, and lichens. The canopy's leaves are very dense and filter out about 80 percent of the sunlight. Many flowers and fruits grow in this layer. Epiphytes cover every available surface and bromeliads provide drinking water for the many canopy creatures and breeding pools for tree frogs.

Some of the animals found in the canopy are the harpy eagle, which preys on monkeys, kinkajous, sloths, reptiles, and other birds. Sloths spend most of their lives in the treetops. Their diet of low-nutrition leaves forces them to conserve energy, causing the sloth to spend 80 percent of its life resting. A large portion of

a howler monkey's diet consists of leaves that are hard to digest. Their metabolism is so low that they need to warm themselves up in the sunlight after a chilly night. Leaf-cutter ants are responsible for harvesting a sixth of the area's leaves, bringing leaf fragments to their underground nests. They play a critical role in the rainforest's ecosystem by pruning the vegetation, which stimulates new growth, and breaking down the leaves to renew the soil.

The understory receives only a small amount of the available sunlight. Plants must find unique ways to adapt to this shadowy existence. Their leaves tend to grow large and are darker green than the leaves found in the main and emergent layers. Vegetation in this zone also tends to be relatively short, growing little more than 12 feet in height. Because there is very little air movement in this zone, the plants must rely on insects and animals to pollinate their flowers. Accordingly, the flowers and fruits of plants in this zone are usually quite large and grow low on the trunks. The lack of wind and abundant sources of flowers and fruits also makes this the layer with the largest concentration of insects.

The forest floor is the lowest layer. It has relatively few plants since only 2 percent of the available sunlight filters through to this level. The floor is littered with decomposing vegetation and organisms that break it down into usable nutrients. Many nutrients are locked into this biomass. Tree roots stay close to the surface to access these nutrients rather than penetrating very far into the soil. Large animals forage for roots and tubers, while insects like millipedes, scorpions, and earthworms use the litter as a source of food.

## PIRANHAS

Naturalists suggest there may be as many as 3,000 different kinds of fish in the Amazon's rivers and lakes. Among these are some of the biggest fish outside the ocean. Among the fish found in the area are the pirarucu, said to be the largest freshwater fish in the world, with some specimens measuring over 6.5 ft (2 m) in length and weighing 275 pounds (125 kg); the tambaqui, which have teeth that can crack seeds as hard as those of the rubber tree and the jauari palm; and the piranha. The ferocity of the meat-eating piranha has been exaggerated. Although it is true that some species have killed large animals and even people, their behavior depends on the state of their habitat and violence toward humans is a rare circumstance. In main river channels and in larger lakes with plenty of food available, they generally pose no threat to swim-

mers. They appear to become aggressive only when they do not have enough nourishment.

Over 500 mammals, 175 lizards and 300 reptiles species, and one-third of the world's birds live in Amazonia. It has been estimated that about 30 million insect types can be found here. Competition for survival is fierce, with the most intense competition taking place between animals and plants.

Despite the abundant riches, the giant trees that grow within the rainforest structure also grow in some of the world's poorest (least nutritious) soils, with the top two inches containing 99 percent of the nutrients. Nine-tenths of the forest's energy is stored in the leaves and tissues of the trees themselves. As soon as a tree falls, decomposers begin to turn it into a food source, as the vegetation to renew the cycle quickly absorbs the nutrients that are released. Because the rainforest ecosystems are the most efficient in all of nature, the destruction of one part of the system can spell the destruction of the whole system.

The climate throughout Amazonia is about the same throughout the year, and the difference between day and night time temperatures is usually greater than that between seasons. Temperatures are warm and humid, averaging around 79 degrees F (26 degrees C).

## EXPLORATION AND ECONOMY

There is archaeological evidence of clustered, densely populated pre-Colombian settlements in parts of the Amazon basin, but at the time of the early European explorations, these settlements had already been wiped out, probably by smallpox and other diseases. The Amazon was probably first seen by Europeans in 1500 when the Spanish commander Vicente Yáñez Pinzón explored the lower part. Real exploration of the river came with the voyage of the Spanish explorer Francisco de Orellana in 1540–41. Not long afterward (1559) the Spanish conquistador Pedro de Ursúa led an expedition down from the Marañon River. In 1637–38 the Portuguese explorer Pedro Teixeira led a voyage upstream that ultimately opened the Amazon. The valley was largely left to its sparse remaining indigenous inhabitants until the mid-19th century, when a few settlements were started and steamship service was established.

In the late 19th and early 20th centuries, the wild-rubber boom on the upper Amazon attracted settlers from Brazil's northeastern states, while Japanese immigrants began developing jute and pepper plantations in the 1930s. Until recently the area has remained largely unpopulated, yielding small quantities of forest prod-

ucts (rubber, timber, vegetable oils, Brazil nuts, and medicinal plants) and cacao. Extensive road networks are now opening the land to colonization, although agricultural success has been limited by adverse climate, poor soils, and the lack of nearby markets.

In the 1960s, the Amazon region began experiencing increased economic development brought on by tax incentives to settle in the west from the Brazilian government and construction of the Trans-Amazon Highway, the Belém-Brasília Highway, and two rail lines. Near Manaus and Amapá, factories are making use of the areas oil and manganese resources.

The Brazilian government implemented a “poles of development” policy in 1974 to plan for population increases in the west. Since 1985, the Carajás project has seen the development of major iron ore deposits, the construction of a new railroad, and the initiation of forest clearance, land colonization, cattle ranching, large-scale farming, and urban development on an unprecedented scale. This policy has had mixed results, however, with significant environmental damage and disruption of native inhabitants’ lives. Over the past 30 years, government-sponsored road-building projects, colonization schemes, and industrial developments have transformed large areas of Amazonia from pristine forest to polluted factory sites and sprawling settlements.

In spite of the numerous development programs, the economy through most of the basin continues to be dominated by primitive agriculture, hunting and fishing, and the gathering of various forest products. Commercial farming, tourism, and industry play only a minor role in the region, but manufacturing, mining, and lumbering, the principal economic activities, are increasingly important.

## MAJOR CITIES

Although there are a few sizable cities along the river’s banks and scattered settlements inland, Amazonia is largely uninhabited. Here and there, plantations have been cleared in the jungles, and natives ply the streams in search of latex and Brazil nuts. But mostly the great green luxuriant rainforest is still pristine wilderness, one of the few large areas left on Earth where nature’s creation remains more or less unspoiled and intact.

For 350 years after the European discovery of the Amazon by Pinzon, the Portuguese portion of the basin remained an almost undisturbed wilderness. It is doubtful if its indigenous inhabitants ever exceeded one to every 5 square mi (13 square km) of territory. A few early settlements on the banks of the main river

and some of its tributaries had been founded by the Portuguese, either for trade with the Indians or for evangelizing purposes. The total population of the Brazilian portion of the Amazon basin in 1850 was perhaps 300,000, of whom about two-thirds were white and slaves, the latter numbering about 25,000.

Manaus, the largest early settlement along the Amazon, is once again one of Brazil’s major cities. Although located 1,200 mi (1,931 km) from the Atlantic, it is a port city with a population of 750,000. Manaus is downriver from the famed “Wedding of the Waters,” or Encontro das Aguas, where the dark Rio Negro and the ochre-tinted Rio Solimões meet and run side by side for some miles before they finally mix. The city was built during the rubber boom, when the Amazon had the only rubber trade in the world. The city enjoyed unbelievable wealth through the turn of the 20th century, with lavish living, splendid buildings, and huge plantations springing up out of the jungle. The rubber trade created a thriving city that attracted entrepreneurs from the United States and Europe. Ultimately, traders found a way to take some of the plants to India and started growing them. With new sources of rubber, the market became oversaturated and eventually collapsed, leaving the cities tied to the rubber trade with the same fate. Today, the city is busy because of government programs encouraging development of Brazil’s west, a duty free zone, and the creation of an active tourist industry.

Belém, the largest of the three major river cities, is located on the Para River, a tributary of the Amazon near the mouth of the Amazon. Belém was founded in 1616 as a fort. During the rubber boom the city was a hot spot of European culture. A port city, it is the capital of the state of Para. The market place in Belém, Vero-O-Peso, is the largest in Brazil.

Iquitos holds the distinction of being the world’s most inland seaport and is accessible only by land or by water. It is the fourth largest city in Peru and the third largest port city on the Amazon. Founded in the 1750s as a Jesuit mission, Iquitos boomed during the rubber days. But the end of the rubber boom in 1920 left the town almost deserted. Today Iquitos is an export center for live animals and aquarium fish, an oil center, and the staging spot for tourism. It also has the largest floating market on the Amazon.

## ISSUES AND CONCERNS

Today, more than 20 percent of the Amazon Rainforest has been destroyed. The land is being cleared for cattle ranches, mining operations, logging, and subsistence



agriculture. Some forests are being burned to make charcoal to power industrial plants. Because rainforest soils are heavily leached, they lack the ability to sustain agriculture for more than a few seasons. Once cut, for whatever reason, a rainforest is likely gone forever. With its passing go untold numbers of species yet discovered as well as habitat and diversity for those that remain. The loss of rainforest also impacts indigenous people by eliminating the hunting and gathering habitat that has sustained them for thousands of years. Today there are fewer than 200,000 indigenous peoples left in Amazonia, and more than 90 tribes have been destroyed since the 1900s

Indigenous peoples have also used different plants as cures and potions for their health and survival. Many of our current pharmaceuticals are based on medicinal chemistry derived from the plant kingdom. Today more than 100 prescription drugs come from plant-derived sources. And although only 25 percent of all drugs are derived from rainforest ingredients, scientists have tested only 1 percent of the potential number of tropical plants that could be available.

In the 1980s, under pressure from international conservation groups, Brazil started to ensure that development efforts in the Amazon did not irrevocably compromise the forest resources. Although recent discoveries of oil and gas have placed increasing pressures on the natural wealth of Amazonia, the Brazilian government has been active in promoting sustainable exploitation policies to manage the Amazon's huge resource reserves. Environmental monitoring and licensing systems have been set up along with national parks to conserve the flora and fauna. Additionally, the rights of Indians and their way of life have been recognized and protected within the reserve system.

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## American Samoa

AMERICAN SAMOA, a territory of the UNITED STATES in the PACIFIC OCEAN, consists of the eastern half of the Samoan archipelago and comprises five volcanic islands: the main island of Tutuila and its smaller partner, Anu'u, plus the islands of Ofu, Olosega, and Ta'u (the Manu'a Islands) to the east.

The territory, with its capital at Pago Pago, is 77.6 square mi (199 square km) and has a highest point at Lata of 3,188 ft (966 m). It has a population of 70,260. The territory also includes the more distant coral atolls, Rose and Sand, and tiny Swains Island, far to the north. The islands extend roughly 186 mi (300 km) from west to east and are located about two-thirds of the way from HAWAII to NEW ZEALAND.

The main town and administrative center, Pago Pago, has one of the best natural deepwater harbors in the South Pacific Ocean, protected from rough seas and high winds. Strategically located at the crossroads of the South Pacific, the harbor at Pago Pago attracted the attention of the U.S. Navy as early as the 1870s and remained a primary coaling point for U.S. ships crossing the Pacific until the end of World War I, when oil replaced coal in most larger vessels. Since then, American Samoa has remained a relative backwater and has thus retained much of its traditional way of life, unlike many of its neighbors.

American Samoa's nearest neighbors are the sovereign states of [Western] SAMOA and TONGA to the west and southwest and the New Zealand dependencies of Tokelau, Cook Islands and Niue to the north, east, and south. The islands lie just to the east of the INTERNATIONAL DATE LINE and at the intersection of the three cultural divisions of POLYNESIA, MICRONESIA, and MELANESIA, though the Samoans themselves fall within

the Polynesian sphere. The islands are volcanic in origin, with rugged peaks and limited coastal plains.

The climate is tropical marine, with ample rainfall, stimulating dense forests on most the islands and allowing cultivation of bananas, coconuts, taro, breadfruit, yams, copra, pineapples, and papayas. Industries are limited to several large tuna canneries, plus local handicrafts and garments. Tourism is not heavy, since there is limited airline service. The canneries were opened in the 1950s and 1960s and constituted 90 percent of all exports in 1995. But few locals want to work there, so half the labor force are aliens, mostly from Western Samoa and Tonga. Young American Samoans are increasingly leaving for the mainland United States for higher education and employment opportunities. The population thus varies widely (for example, in 1984 it was given as only 36,000). About 90 percent live on Tutuila, mostly near Pago Pago.

The islands were settled long before European contact in the 18th century. Native chiefs looked to the United States in the late 19th century for protection against the squabbles of European colonial powers. The first treaty with a local chief allowing U.S. boats to anchor in Pago Pago Harbor was signed in 1872, and negotiations between Great Britain, Germany, and the United States led to a partition in 1899 (at 171 degrees west longitude), though the ranking Samoan chiefs did not formally cede their territories until 1904 (after the United States had already set up its administration).

The larger islands in the group, Upolu and Savai'i, went to Germany and from 1962 formed the independent nation of Samoa. The population of the eastern islands in 1900 was less than 6,000. After World War I, the Samoans were mostly left to themselves, and their traditional system of government and family-based communal landownership was preserved. Subsistence economy was successful and local traditions were strong, so many Western influences were either rejected or, like Christianity, molded to fit the Samoan way.

Since 1951 the islands have fallen under the jurisdiction of the U.S. Department of the Interior, and a new constitution was adopted in 1966, but, unlike America's other territories in the Pacific, there is little desire to change the status quo, either toward independence or toward closer affiliation with the United States. The islands rely on heavy subsidies and welfare programs but are also wary of losing their traditional way of life by submitting entirely to U.S. law (for example, the continuation of government leadership by semi-hereditary chiefs, the matai, and the system of

communal landholding, under which about 92 percent of the land continues to be held by traditional kin groups). American Samoa thus remains an unorganized, unincorporated territory of the United States. Samoans are mostly self-governing, and strict restrictions of immigration are intended to preserve their autonomy and traditional culture.

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## Amu Darya

THE AMU DARYA has served as a bridge between cultures for several millennia. A river that flows straight across one of the harshest deserts in the world, it has served as a natural highway for migrants and invaders from Central Asia to South Asia and the MIDDLE EAST, as well as a boundary for the empires established by these same invaders. The Amu Darya starts high in the HINDU KUSH mountains at the boundaries of AFGHANISTAN, KASHMIR, CHINA, and TAJIKISTAN, at an elevation of 16,170 ft (4,900 m). From there, it descends rapidly to the great central Asian lowlands, which are mostly covered by the Kara Kum and Kyzyl Kum deserts. Much of the river's water is lost to evaporation and irrigation, so water levels are actually lowest when it finally reaches its mouth in a large delta on the ARAL SEA, 1,500 mi (2,419 km) later.

The river was known as the Oxus (or the River Styx, River of Hades) to the ancient Greeks and formed the northern extremity of the lands conquered by Alexander the Great in the 4th century B.C.E. The lands that now form UZBEKISTAN and KAZAKHSTAN were thus known for much of their history as Trans-Oxiana. The river's current name comes from the ancient city of Amulya (near Chardzhou), plus *darya* (Turkic for "river"). Irrigation has long been vital to cities in the region, cities whose importance was heightened as stops on the SILK ROAD from Persia to China. Important sultanates grew up around the cities of Khiva, near the

delta, and Bukhara further upstream, near the confluence of the deserts and the foothills of the great mountains to the east. Fertile desert soils, watered by the Amu Darya and bathed in unending sunshine, were famous for their production of extra sweet fruits, notably apricots, dates, and melons, and aromatic plants such as lavender and sage. Imperial Russian and later Soviet administrations increased the development of irrigation of the Amu Darya valley, making Uzbekistan into a leading producer of cotton, but have also caused the ARAL SEA to shrink to in size. At some times during low water, the Amu Darya does not even reach the Aral at all.

The Amu Darya basin drains 208,558 square mi (534,764 square km), including most of Tajikistan, northern Afghanistan, and a small area of south KYRGYZSTAN. Seventy-two percent of the basin is arid, while 22 percent is cropland through irrigation. Nearly from its source in the Wakhan panhandle of northeastern Afghanistan, the river serves as the border between that country and Tajikistan, and is fed by several swift-moving mountain tributaries from both countries.

The river is called the Vakhsh Darya until it is joined by the largest of these tributaries, the Vakhsh, from Tajikistan, then assumes the name Amu Darya. At its emergence from the foothills of these great mountains, the river valley becomes the border between Uzbekistan and Turkmenistan, though much of the river itself lies within the latter until the city of Chardzhou, and within the former from Khiva to the delta. In this segment, the river is slow and wide and receives no tributaries at all and very little rain, thus losing approximately 25 percent of its volume before it reaches the Aral Sea.

Chardzhou, the largest city in northeastern Turkmenistan, marks the boundary between semidesert and desert; from this point on, the sands of the Kara Kum approach the river directly and add considerably to the already heavy load of silt, sand, and mud being carried by the river from the mountains. The Amu Darya is considered the most heavily silted river in the world, with its high volume of suspended material giving it its characteristic murky yellow coloring.

The eastern parts of the river in Turkestan have natural gas reserves. Transportation from this interior is linked to Turkestan's capital and ports on the CASPIAN SEA by the Kara Kum Canal and a railroad link that crosses the Amu Darya in an impressive mile-long bridge at Chardzhou. The Amu Darya itself is little used for commercial traffic, since the Aral Sea connects with no other bodies of water, and the river itself is

filled with constantly shifting sandbars and a variety of meanders.

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## Amur River

THE AMUR RIVER, in Siberia, springs from the confluence of the Shilka and Argun Rivers east of Lake BAIKAL and flows over 1,800 mi (2,897 km) toward the Tatar Straits, the passage between Sakhalin and the Russian Pacific Coast. With all tributaries, the Amur basin covers nearly 750,000 square mi (1,942,491 square km) of area. The Russian push into the river valley in the mid-17th century resulted in a border clash with the Chinese Empire. The Treaty of Nerchinsk (1689) admitted the territorial sovereignty of the Manchu dynasty over the Amur region for 150 years. The Chinese know the river as the Heilongjiang. In the mid-19th century, the Amur, as the lone river in Siberia that flows eastward to the PACIFIC OCEAN, gained geopolitical significance for the Russian Empire. After the unequal treaties concluded with CHINA in 1850 and 1860, RUSSIA annexed the Amur region.

Russian 19th-century geographers spoke of the Amur as Russia's gateway to the Pacific. Not only is the river abundant with fish, but also the mild climate is appropriate for agriculture (grain, vegetables, fruits). A systematic geographical exploration of the river by the Russians began in 1824 with Grigorii Spasskii's study "Historical and Statistical Notes about Places along the River Amur." In 1846, navigator Alexander Gavrilov sailed to the mouth of the Amur and reported that the river was too shallow for even small ships. This was revised by Gennadii Nevel'skoi's expedition in 1849 that found that the mouth of the Amur was navigable by ships of any size.

The Russian government feared a British occupation of the river mouth and the east Siberian general governor, Nikolai Murav'ev-Amurskii, coined the

Russian geopolitical logic that whoever shall control the mouth shall control Siberia to Lake Baikal. In 1856, the tzarist government declared the Amur region a free trade zone. After the emancipation of the serfs (1861), the government supported the free colonization with tax exemptions. Though some thousands of peasants settled along the Amur, the region remained underpopulated until the modern era.

In view of the illegal migration between 1860 and World War I, the tzarist government founded the so-called Amur Cossack Division, which supervised the border line along the river. In the Russian Civil War (1917–22) Japanese troops occupied the Amur region. Again in the 1930s and in the late 1960s, the Amur became a military trouble spot between the Soviet Union and its East Asian neighbors, JAPAN and China. In the era of Sino-Soviet confrontation, the Soviet government created a frontier ethos that was, at least, reflected by the construction of the BAM (Baikal-Amur-Magistrale). After the breakdown of the Soviet Union in 1989, the Amur region experienced a population outflow to European Russia that resulted in a declining industrial production. Nevertheless, the Amur region seeks economic cooperation with nearby China and facilitates border trade between the cities Blagoveshchensk and Heihe.

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## Anatolian Plateau

THE ANATOLIAN PLATEAU is the central upland region of the ancient region of Anatolia, today's TURKEY. The plateau is hemmed in by two parallel mountain ranges, the Taurus to the south, along the Mediterranean coast, and the Pontic Mountains to the north, along the coast of the BLACK SEA. Anatolia has served as a bridge between the civilizations of Europe and Asia for thousands of years, with waves of different cultures taking advantage of this central position

and establishing cities and empires on the plateau. Site of the first large empire of the Western world, the Hittite, dating from the 15th century B.C.E., the plateau was later given its modern name Anatolia, or "rising sun" by the Greeks looking eastward.

Most of the Anatolian Plateau lies at elevations above 1,640 ft (500 m). This mountainous region lies at the center of the Arabian, African, Eurasian, Aegean and Turkish tectonic plates: the resulting landscape is dotted with volcanoes (today extinct) and regular earthquakes. The central plateau is composed of uplifted blocks and downfolded troughs filled by shallow salt lakes. Elevations on the plateau itself range from 1,980 to 3,960 ft (600 to 1,200 m). This increases to the east, where the two mountain ranges, the Taurus and Pontic, join to form the eastern highlands (including the highest mountain peaks in Turkey such as Mount Ararat).

The two largest basins on the plateau are the Konya Ovasi and the basin occupied by Tuz Gölü (Salt Lake)—both drain large inland areas and have no external outlet. Other parts of the plateau are drained either by short rivers that flow south into the Mediterranean, or by several larger rivers (notably the Halys and the Sakarya) that drain northward into the Black Sea. Two extinct VOLCANOES, Erciyes and Hasan, left behind lava flows that have eroded over time to form spectacular landscapes of rock cones and capped pinnacles in Goreme, near Nevsehir. The earth in these areas is colored a variety of grays and reds.

The plateau is mostly dry with a mixture of dark and desert soils. Summers here are hotter and drier than in the rest of Anatolia, but also colder and wetter in the winter, with temperatures averaging freezing and frequent heavy snows. The plateau is mostly covered in STEPPE, with short grasses, bushes and stunted willow trees.

Wooded areas are confined to the northwest and northeast, and cultivation (wheat and barley) is restricted to narrow river valleys. IRRIGATION is practiced where water is available, but a deeply entrenched river course makes it difficult for engineers to raise the water to the surrounding agricultural land. Summer dust storms, locusts, extreme heat, and occasional droughts limit agricultural output. Some areas are cultivated with orchards and vineyards, but for the most part the land is used for grazing. Some larger animals live in the highlands (wolf, fox, bear), but the ubiquitous domesticated Angora goat is everywhere. Stock raising is important and overgrazing has also caused some erosion problems.



The capital of the republic of Turkey was moved to the Anatolian Plateau in 1923. The city of Ankara was chosen as the capital of the new state to remove it from connotations of the imperial capital at Istanbul and to place it in the geographic center of the country. The region is also home to ancient ruins of the Hittite civilization at Çatal Hüyük and to the underground cities of Kaymakli and Derinkuyu, ancient refuges for early Christians. Konya (Roman Iconium) is the region's major cultural center, known for its mosques and "whirling dervishes."

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## ancient empires and explorations

SINCE THE BEGINNING of history, human beings have explored the Earth. With the creation of empires, the explorations were often connected to great expeditions made to conquer new territories or to open new commercial roads. The ancient empires and their explorations include the following.

EGYPT appeared as a unified state around 3300 B.C.E. About 3100 B.C.E., Egypt was united under Menes, who inaugurated the 30 pharaonic dynasties in which Egypt ancient history is divided: the Old and the Middle Kingdoms and the New Empire. The Egyptians reached Crete around 2000 B.C.E. and were invaded by Indo-Europeans and Hyksos Semites. They defeated the invaders around 1570 B.C.E. and expanded into the AEGEAN SEA, SUDAN, LIBYA, and much of Southwest Asia, as far as the Euphrates River. It survived as an independent state until about 300 B.C.E.

Sumerians lived in the southern part of Mesopotamia from the time of settlement until the time of Babylonia. The Sumerians inhabited various city-states, each built around a temple dedicated to the god of the city and ruled over by a king, who was tied to the city's religious rites. Discoveries of obsidian from places in Anatolia (modern TURKEY) and AFGHANISTAN,

pearls from Dilmun (now BAHRAIN), and many seals inscribed with the Indus Valley script, suggest a considerable wide-ranging network of ancient trade around the PERSIAN GULF. The Epic of Gilgamesh refers to trade with far lands for goods such as wood that were scarced in Mesopotamia. In particular, cedar from LEBANON was appreciated.

Assyria, a country on the Tigris River, was in the beginning a colony of Babylonia and was ruled by viceroys from that kingdom, founded in 1700 B.C.E. In 1120 B.C.E., Tiglath-Pileser I, the greatest of the Assyrian kings and founder of the first Assyrian Empire, crossed the Euphrates, defeated the kings of the Hittites, conquered Carchemish and advanced on the coasts of the MEDITERRANEAN SEA. In 745 B.C.E., Pul, who assumed the name of Tiglath-Pileser III, directed his armies into SYRIA and took it in 740 B.C.E. Azariah was an ally of the king of Hamath, and thus was obliged by Tiglath-Pileser III to pay him homage and give a yearly tribute. In 738 B.C.E., in the reign of Menahem, king of Israel, Tiglath-Pileser III invaded Israel. The king Assurbanipal entered on a conquering career and, having absorbed Babylon, the kingdoms of Hamath, Damascus, and Samaria, conquered Phoenicia and made Judea feudatory, and subjugated Philistia and Idumea.

Phoenicia was an ancient civilization with its heartland along the coastal plain of what is now Lebanon and Syria. Phoenician civilization was an enterprising maritime trading culture that spread right across the Mediterranean during the 1st century B.C.E. Phoenicians founded independent city-states like Byblos, Tyre, Tripolis, and Berytus, as well as others on the islands and along other coasts of the Mediterranean Sea. This league of ports was then ideally suited for trade between the Levant area rich in natural resources and the rest of the ancient world. Byblos soon became the main center from where they proceeded to dominate the Mediterranean and Erythraean sea routes. Byblos was attacked by invaders, and by around 1000 B.C.E. Tyre and Sidon had taken its place. In the centuries after 1200 B.C.E., the Phoenicians formed the major naval and trading power of the region.

The Phoenicians established commercial outposts throughout the Mediterranean, the most notable being Carthage in North Africa, with others in CYPRUS, Sicily, Corsica, Sardinia, SPAIN, and elsewhere. The Lebanese, Maltese and some Somalians still consider themselves descendants of Phoenicians. Their ships ventured out into the ATLANTIC OCEAN as far as Britain, where the tin mines in modern Cornwall provided them with impor-



tant material. They also sailed south along the coast of Africa. A Carthaginian expedition led by Hanno the Navigator explored and colonized the Atlantic coast of Africa as far as the Gulf of Guinea, and a Phoenician expedition sent out by Pharaoh Necho II of Egypt even circumnavigated Africa.

## GREEK EMPIRE

Greece is a region on the south of the European continent. It is defined by mountains, surrounded on all sides except the north by the sea, and endowed with large and small islands. The Ionian and AEGEAN SEAS and the many bays allowed the Greeks to prosper in maritime commerce and to develop a culture that was inspired from many sources, both foreign and local. The Greek world spread far beyond Greece itself, including many settlements around the Mediterranean and BLACK SEAS. The mountains, which served as natural obstacles and boundaries, imposed the political character of Greece.

From early times the Greeks lived in independent communities isolated from one another by the landscape. Later these communities were organized into CITY-STATES. The mountains prevented large-scale farming and prevented the Greeks to look beyond their borders to new lands where fertile soil was more abundant. The Greeks started to sail the seas to conduct commerce since very ancient times and reached the Pillars of Hercules, but the great movement of expansion of Greek people was between the 8th and 7th centuries B.C.E., enlarging geographical knowledge. These travels that prepared the Greek colonization of Mediterranean area were true explorations. The result was important for the knowledge of the entire Mediterranean Sea and Black Sea and the surrounding area, into the internal mountains of Asia and eastern Africa.

The expansion of Alexander the Great's kingdom started in 336 B.C.E., when he succeeded his father to the throne of Macedonia. After that, Alexander began a military expedition with the intention of conquering the Persian territory in Asia Minor and set Egypt free, becoming the emperor of a new huge realm. At its greatest extent, this empire covered over 3,000 mi (4,828 km) from Greece to INDIA, enclosing Egypt and Persia, up to the river Indo. The capital of this dominion was Alexandria in Egypt, founded about 331 B.C.E. During army marches, country by country, several teams of geographers, botanists, and other men of science collected information and specimens for Aristotle, the mentor of Alexander. While a historian kept records of the march, cartographers made maps that

served as the basis for the geography of Asia for centuries.

To administer his empire, Alexander adopted a type of monarchy already used in the Persian Empire, introducing in his court also some elements like uniforms and customs from the Persian culture. This kind of government did not agree with the different populations under Alexander's control, and they rebelled. Alexander tried to stop these tumults by proclaiming and encouraging the formation of a hegemony among different people living in his kingdom. This project died with its promoter, Alexander, starting an age of war among his successors and marked the beginning of the decline of this empire. After 40 years of conflict, the conquered territory was divided into three regions: Egypt went to the Ptolemys, the kingdom of Syria submitted to the Seleucids, and the Antigonids took Macedonia. These new realms, so-called Hellenistic, brought the Greek culture into Asia and Egypt, creating times of prosperity for all thanks to a large availability of precious metals and other types of goods, mainly treasures from the Persian War. New commerce routes were established and in Alexandria, the largest library of the ancient world was built. The campaigns of Alexander in Libya and in Asia reached Turkestan and India, revealing a lot of new great mountains and large deserts, the great rivers of India, and the Southern Ocean (sailed for the first time by the fleet of Nearco from the Indo to the Euphrates).

## ROMAN EMPIRE

The power of Rome (founded in 754 B.C.E.) started with its expansion in Italy and in Europe and finally in the Mediterranean area and farther. After the kingdom and the republic, the Roman Empire started with Augustus in 27 B.C.E. The greatest expansion was during the reign of Trajan (98–117), when he conquered Dacia. In this age, the Roman Empire extended from Spain to the West Pontus and North Arabia to the east, from Britannia to the north, and to the North African coasts in the south. Constantine transferred the capital of the empire in Byzantium, and his heirs divided the empire into two parts. The empire died in its occidental form in 476, when Odoacre deposed the last emperor and transferred the power in Constantinople. The eastern half of the empire remained the heartland of the Roman state until 1453, when the Byzantine Empire fell to the Ottoman Turks.

The administration of the Roman Empire was divided in provinces. The number and size of provinces changed according to internal Roman politics. Under

the Roman republic, the governor of a province was appointed for a period of one year. At the beginning of the year, the provinces were distributed to future governors by lots or direct appointment. During the empire, the biggest or more garrisoned provinces were subdivided into smaller provinces in order to prevent a situation where a unique governor held too much power, thus discouraging ambition for the imperial throne itself. With the formation of the principate after the civil wars ended the Roman republican period, Augustus retained the power to choose governors for the provinces in which he and his successors held supreme military and administrative control. Thus, the more strategically critical provinces, generally located along the contested borders of the empire, became imperial provinces. The remaining provinces were maintained as senatorial provinces, in which the senate had the right to appoint a governor. During the empire of Diocletian, the diocese was created, a large administrative unit made up of up to 16 provinces. The empire was separated into 12 (or later, 15) dioceses. Each diocese was governed by a praetor vicarius who was subject to the prefect.

Everywhere the Roman Empire extended, great architectural structures were built. A great road network connected the entire Roman Empire, facilitating trade and exploration. From the second half of the 2nd century B.C.E., until the first century, the military campaigns that consolidated the Roman Empire helped the progress of geographic knowledge. The Greeks, as a mainly seafaring people, explored the coastlands; thanks to the Romans, knowledge of the inside lands also became known. The Alpine regions of the Gallia, the interior of Iberia, and Britain and Germany were finally explored. North African lands were explored, from Ethiopia and the Nile Valley beyond the confluence of the two principal branches (during the empire of Nero), to Libya, where military expeditions scouted the middle of the SAHARA DESERT and the ATLAS MOUNTAINS in MOROCCO.

In Asia, the mountainous regions of ARMENIA, Arabia, and the lands beyond the Pontus were explored. The knowledge about the Torrid Zone of the world was revised with the discovery of the existence of Ethiopic people living beyond the African desert. The existence of nomad people living in northern Europe, where Romans thought lived the fabulous Iperboreans, was also proved.

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## Andes

THE ANDES IS A mountain system in South America. The mountains form the “backbone” of South America, stretching from the Caribbean coast along the western side of the continent to its southern tip. The name *Andes* probably derives from either Quechua or Aymara, the two principal Native American languages of South America. Plate-tectonic forces during the Cenozoic Era created the Andes. The mountains are a result of a collision between the continental South American plate and the oceanic Nazca plate that created high peaks and steep slopes. The region is still tectonically active, as earthquakes are common and there are frequent volcanic eruptions. The Andes sometimes serve as a geographic boundary that divides countries, as is the case of the border between ARGENTINA and CHILE. The mountains also divide regions within individual countries.

The highest peaks are found in Argentina, PERU, and ECUADOR. ACONCAGUA MOUNTAIN in Argentina is the highest peak in the Western Hemisphere at 22,834 ft (6,960 m). The lowest peaks are found in the southern and northern extremes. The Andes are widest in BOLIVIA, where there are actually two distinct ranges known as the Cordillera Occidental (Western Range) and Cordillera Oriental (Eastern Range).

Much of the Andes lies in the tropics. However, altitude is generally more of a determining factor than latitude. Indeed, there are even glaciers and snow near the equator. Climate and vegetation are also determined by altitude. Furthermore, elevation affects temperatures, even at the same latitude. Temperatures tend to decrease about 3.7 degrees F for every 1,000-foot (305 m) increase in altitude. For example, Quito, Ecuador, located high in the Andes, has an average annual temperature of 54.6 degrees F (12.5 degrees C). Guayaquil, Ecuador, located at almost the same lati-

tude, but on the coast, has an average temperature of 78.2 degrees F (25.6 degrees C).

In the tropics, different elevations are divided into several distinct categories. Altitudes up to about 3,000 ft (914 m) are referred to as *tierra caliente* (hot country). Elevations located between 3,000 and 6,000 ft (914 m and 1,829 m) are called *tierra templada* (temperate land). *Tierra fria* (cold land) can be found at altitudes of 6,000 to 12,000 ft (1,829 m to 3,657 m). Finally, regions above 12,000 ft (3,657 m) are classified as *tierra helada* (frozen land).

Much of the Andean region is arid, including the Atacama Desert. On the western side of the Andes, streams do not have well-defined headwaters. In contrast, on the eastern side, there is more rain and more significant headwaters. Two of South America's major river systems—the AMAZON and the Orinoco—both begin in the Andes.

The high altitudes of the Andes make human settlements in the region difficult. Nevertheless, shepherds in southern Peru have lived permanently at altitudes above 17,000 feet (5,181 m). Temporary mine workers have lived at altitudes around 19,000 ft (5,791 m). In general, the southern Andes are sparsely populated. There is a heavier concentration of people on the plateaus from Bolivia to COLOMBIA. Many people in countries such as Peru and Bolivia reside above 10,000 feet (3,048 m). Some of the continent's largest cities are located on these central Andean plateaus, including Santiago (Chile), Lima (Peru), Quito (Ecuador), and Bogotá (Colombia).

Before 600 C.E., human beings concentrated along the PACIFIC OCEAN coast rather than in the Andes. After that date, a number of advanced Native American civilizations established themselves in the Andean highlands. The two largest states before 1000 C.E. were Tiahuanaco, south of Lake TITICACA, and the Huari, centered near modern-day Ayacucho. After 1000, the most significant group was the Chimú, with its capital at Chanchán. The Chimú kingdom lasted until the 15th century, when the Incas conquered it. The great Inca Empire, with its capital at Cuzco, dominated much of the region during the 15th and 16th centuries.

In the 1530s, Spanish conquerors subdued the Incas, bringing the Andes into Spain's New World empire. The Spanish often used systems of forced Native American labor to work in Andean silver mines. The native inhabitants did not always readily accept Spanish rule. In the 18th century, there were more than 100 native rebellions, including the great uprising led by José Gabriel Condorancú in 1780. In the 19th cen-



Because of the range's length, position, and curvature, the Andes Mountains are called the "backbone of South America." The Andes run through the countries of Colombia, Ecuador, Peru, Bolivia, Chile, and Argentina and reach heights above 20,000 ft or 6,095 m.



tury, the Spanish colonies achieved their independence. Parts of the Andes can be found in VENEZUELA, Colombia, Ecuador, Peru, Bolivia, Chile, and Argentina.

Agriculture in the Andes has always been difficult. Crop yields are generally low. Many areas are dry or receive irregular rainfall. Temperatures are often too low for agriculture. Therefore, most agricultural production is for local consumption rather than for export. However, some products grow well enough to serve as export products. Colombian coffee is world renowned. Illegal drug traffickers utilize Andean coca to produce cocaine for export around the world.

The Andes is one of the world's most important mining regions. Among the most mined minerals are gold, silver, copper, tin, platinum, and emeralds. Silver in particular played an important part in the Spanish colonial period. Potosí, located in modern-day Bolivia, was the richest silver mine in the world and large boom town grew up around it. Along the eastern side of the Andes, there are substantial deposits of oil.

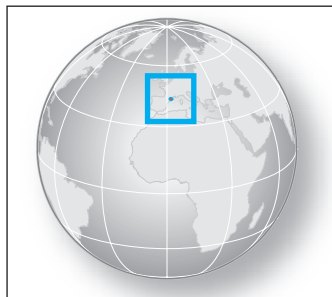
The Andes have long been a barrier to trade and communications in South America, especially to east-west travel. Centers of agricultural and mining production have generally been located far from ports on the coasts. People in the Andes long depended on pack animals to transport goods through the mountains. Railroad and road construction has often been difficult, though air travel has made the region more accessible.

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## Andorra

**Map Page** 1131 **Area** 183 square mi (468 square km)  
**Capital** Andorra la Vella  
**Population** 69,150 **Highest Point** 9,722 ft (2,946 m)  
**Lowest Point** 2,772 ft (840 m) **GDP per capita** \$19,000  
**Primary Natural Resources** hydropower, timber.



ONE OF THE WORLD'S true curiosities, the sovereign coprincipality of Andorra retains independent status which, according to local history, was granted in the 9th century by Charlemagne for the people's valiant services to him against the Moors. Consisting of the upper valleys of the river Valira, this tiny country is nestled among the high mountain passes of the Pyrénées between FRANCE and SPAIN. Only 2.5 times the size of Washington, D.C., it is one of the smallest countries in the world. What makes Andorra truly curious, however, is its unusual status as a coprincipality, though without a local prince; instead, it is governed jointly by the republic of FRANCE and by the Bishop of Urgell, a small town a few miles to the south in Spain. The French president and the bishop act as coprinces only nominally, however, and since 1993 the country has been entirely sovereign and self-ruling.

### PEAKS AND VALLEYS

Andorra is located between the French department of Ariège, in the region of Midi-Pyrénées, and the Spanish province of Lérida (or Lleida) in the region of Catalonia. Consisting of high mountain peaks and narrow valleys, the elevation of Andorra ranges from 6,500 to 10,000 ft (2,000 to 3,000 m). The climate is fairly severe, restricting vegetation to minimal mountain scrub: One suggestion of the origin of the name *Andorra*, is that it comes from a local term for "shrub-covered." But this climate provides excellent high mountain pastures for sheep and cattle and is also a great attraction for skiers from all over Europe. The economy runs mostly on tourism, with numerous summer and winter resorts, and also as a duty-free shopping center. Much of Andorra remains rural. Most of its inhabitants live in one of six main villages, raise their herds of sheep or cattle, and manage small farms, raising rye, wheat, barley, oats, and vegetables. There are also some fruit orchards and vineyards. Most of the population lives in and around the capital, Andorra la Vella, where there is some light manufacture, notably cigarettes, sandals, and anisette liqueur.

The coprincipality has been jointly ruled since a treaty in 1278 between the Count of Foix and the Bishop of Urgell. At that time, there were several small states between France and Spain; the unusual thing is that this one survived into the 21st century. The pass of Port d'Envalita (7,943 ft or 2,407 m) has served as a major route between Toulouse, France, and northern Spain since ancient times. While the status of the bishop remained the same, the Counts of Foix eventu-

ally died out and the title was absorbed by the king of France in the 17th century. After the French Revolution, the post naturally fell to the president of the republic. In 1993, Andorrans voted in favor of a new constitution that, while retaining the honorific position of the coprinces, gives Andorra complete sovereignty and control over its affairs, both internal and external. It has been a member of the EUROPEAN UNION (EU) since 1990, uses the euro, and became a full member of the United Nations in 1994. But Andorra's position as a free-port also brings with it the associated problems of smuggling and money laundering, the subject of an accord settled between the five European microstates and the EU in 2003.

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## Angola

**Map Page** 1116 **Area** 481,351 square mi (1,246,700 square km) **Population** 12,386,000 **Capital** Luanda **Highest Point** 8,594 ft (2,620 m) **Lowest Point** 0 m **GDP per capita** \$865 (2002) **Primary Natural Resources** petroleum, diamonds, natural gas.



A COUNTRY LOCATED along the southwest coast of Africa, the republic of Angola is a vast territory divided into 18 provinces, one of which, Cabinda is an exclave within neighboring CONGO. The Berlin Conference of 1885–86 determined the current borders with the Republic of the Congo, Democratic Republic of the CONGO, ZAMBIA, and NAMIBIA. Portuguese is the official language, but Umbundo and several other African languages are also spoken in rural areas. Angola has a semi-presidentialist system, with the president being both chief of state and head of government.

From a coastal plain, the land rises in stages toward the high interior plateaus, covered mainly with grasslands and bushes. There are tropical forests in the north, and a rocky desert occupies the southwest cor-

ner. Angola's climate is tropical, humid in the north with a cool dry season (May to September) and a warm rainy season (October to April), and becomes semiarid in the south.

## HUMAN GEOGRAPHY

Humans have lived in the area that is now Angola since prehistoric times, with Bantu-speaking peoples settling there about 2,000 years ago. The Portuguese arrived in the 1480s and built fortresses and outposts along the coast. In the following three centuries, Angola became a primary source of slaves for the Americas, especially for BRAZIL. In the 20th century, thousands of Portuguese moved to Angola, seeking a better life in a land of great natural resources and potential. In 1975, Angola gained independence from Portugal. War has been the norm in the last 40 years, costing more than 1.5 million lives, leaving the economy in disarray, and causing destruction of basic infrastructures and widespread presence of post-battle land mines.

Ethnicity plays an important role in the country, with most of the population of Bantu origin. Other groups include the Ovimbundu, the Mbundu, and the Kongo. The capital and largest city is Luanda (3 million people), and main cities include Cabinda, Benguela, Lobito, and Lubango. The majority of the young population lives in rural areas and depends on subsistence agriculture. Life expectancy is low in this African country.

Angola has enormous natural resources, among them petroleum off the northwest coast, and diamonds in the northeast. Oil contributes with almost half the GDP and more than half of exports. Main economic activities are mining, logging, and farming. Agricultural production includes bananas, cassava, coffee, sugarcane, sisal, corn, cotton, and manioc, but much of the food is imported. The rich fisheries nurtured by the Benguela current along the 994-mi (1,600-km) coast are still underexploited. The country also has significant hydroelectric potential, since the central highlands are the source of many important rivers, such as the Cuanza, Cunene, and Cubango.

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## Anguilla

ANGUILLA IS ONE of the smallest and least developed islands in the CARIBBEAN SEA. It was administered as a British colony along with SAINT KITTS AND NEVIS until 1971. Its inhabitants did not wish to remain a dependency of its larger neighbors when they achieved independence in 1983, and Anguilla opted instead to retain its status as an overseas dependency of the UNITED KINGDOM (UK).

Unlike St. Kitts and Nevis, Anguilla is not made up of volcanic peaks with fertile soil and abundant rainfall, but instead consists of flat, semiarid coral and limestone formations that are generally unproductive for any sort of agriculture. This marks the main contrast between the two arcs of the Lesser Antilles: the older arc, further to the east, was once volcanic but sank beneath the sea; the tips became covered in limestone and coral and slowly reemerged from the sea, but rarely higher than 330 ft (100 m). This is the case for Anguilla and its closest neighbors, the French dependencies of St. Martin and St. Barthélemy to the south and the British Virgin Islands to the west.

Anguilla also includes some smaller islands, Scrub and Dog, and the Prickley Pear Cays, plus the tiny island of Sombrero, with a lighthouse important for regional shipping. Anguilla is located on the strategic Anegada Passage, a primary shipping route between the ATLANTIC OCEAN and the PANAMA CANAL, but lacking any substantial port or harbor, it has been unable to take advantage of this position. The terrain is mostly rocky, with sparse scrub and few trees. Some areas do produce small quantities of tobacco and vegetables or support cattle. Other areas are dedicated to commercial salt manufacture through evaporation ponds. The economy relies instead on tourism—with its excellent beaches and reefs—plus boat building and offshore financial services, though none of these industries produces sufficient revenue to allow the country to sever its ties with the UK, which provides heavy subsidies.

Originally named by the Spanish *anguilla* or “eel” because its long narrow shape, the island had no interest for the gold-seeking Spaniards. It was not until the 1650s that the first settlers claimed the island for Britain. Administered with St. Kitts and Nevis from 1825, it never developed a sugar economy like theirs, and when the three islands achieved internal self-rule in 1967, Anguilla declared its intentions to separate from the other two (located over 62 mi or 100 km to the southwest). The government, with British support, is attempting to develop its tourism industry but has been

hampered by successive hurricane damage, notably Hurricane Luis in 1995.

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## Antarctic Circle

THE ANTARCTIC CIRCLE is an imaginary line located at 66.5 degrees south latitude or 23.5 degrees northward of the South Pole. It marks the southernmost location where the sun can be seen on June 22 (the Southern Hemisphere’s winter solstice) and the northernmost location where the midnight sun is visible on December 21 (the Southern Hemisphere’s summer solstice).

On June 22 and again on December 21, the circle of illumination, formed by the sun’s rays striking the Earth, extends from the edge of the Antarctic Circle in the south to the ARCTIC CIRCLE in the north. On June 22, the area within the Antarctic Circle experiences 24 hours of darkness and on December 21 it receives 24 hours of sunlight. The name *Antarctic* comes from the Greek *arktos*, or “bear,” in reference to the area’s position below the Great Bear constellation (Ursa Major).

British naval captain James Cook was the first to cross the Antarctic Circle in 1773. Exploration of the region within the Antarctic Circle resumed in 1820 when the explorer Fabian Gottlieb von Bellingshausen received support from Russian Tzar Alexander I to explore the south polar region. On January 26, 1820, Bellingshausen’s ship, the *Vostok*, crossed the Antarctic Circle, becoming the first to do so since Cook in 1773. Other early explorers of the region include English naval captain Edward Bransfield and American seal hunter Nathaniel Palmer.

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## Antarctica

THE WORLD'S fifth-largest continent, Antarctica is home to the South Pole. This continent of almost 98 percent ice and 2 percent barren rock holds the distinction of being the coldest, windiest, driest, and highest continent. Antarctica covers some 5.4 million square mi (14 million square km), and has no indigenous people, but seasonal staff from 1,000 to 4,000 people. The continent's highest point is Vinson Massif at 16,066 ft (4,897 m) and lowest point is the Bentley Subglacial Trench at -8,382 ft (-2,555 m).

Frequent, gusty winds blow from the interior sections toward the coast, and blizzards are common along the foot of the plateau. Volcanoes are scattered along areas of West Antarctica, and large icebergs frequently break off from the ice shelf. Cold temperatures are spread across the continent. The higher elevations of East Antarctica provide the coldest temperatures. A more moderate climate is found on the Antarctic Peninsula, where high temperatures average closer to freezing.

Although the climate is incredibly harsh and dry, plant species, albeit small in size, are numerous. Hundreds of algae species are scattered across the land, as well as around 100 species of moss, 350 species of lichen, and 2 grass species. The subantarctic islands surrounding Antarctica have a wider range of flora. About 45 bird species populate the area south of the Antarctica Convergence, and a few penguins and petrels actually live on the continent. The waters surrounding Antarctica are full of seabirds, fish, seals, and whales.

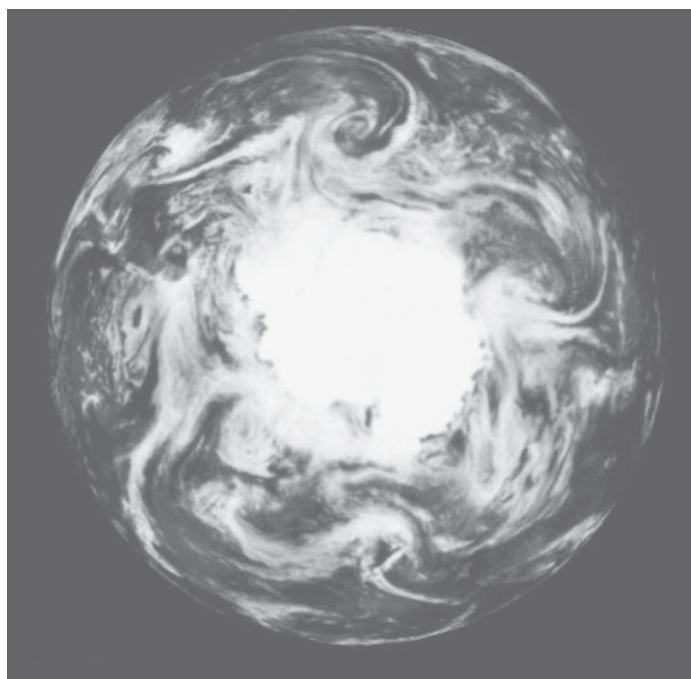
The continent remained untouched by humans until the 19th century. In 1773, British sea captain, James Cook was the first to cross the ANTARCTIC CIRCLE, but never saw any of the landmass. Almost five decades later, in 1819, the Russian naval officer Fabian von Bellingshausen discovered some of the islands. However, it was not until a year later that British naval officers William Smith and Edward Bransfield discovered the landmass. A few months later in November 1820, an American sealer, Nathaniel Palmer, also discovered the continent.

In 1822, another American sealer, Captain John Davis, became the first person on record to land on the continent. For the remainder of the decade, British, French, and American expeditions navigated the land and proved that Antarctica was indeed a continent. In 1838, Lt. Charles Wilkes of the U.S. Navy explored some 1,200 miles of the Antarctic Peninsula.

From the late 19th century until 1916, explorers across the world were engaged in a race to see who would first reach the South Pole. In 1902, the British explorer Captain Robert Falcon Scott led an expedition to Antarctica with Ernest Shackleton and Edward Wilson. They were forced to abandon the adventure because of the harsh conditions and scurvy. Five years later, Shackleton attempted to travel to the South Pole, but within 97 mi (156 km) of the South Pole, his supplies dwindled and he had to abandon the effort.

On December 17, 1911, the Norwegian explorer Roald Amundsen and his team of four were the first to reach the heralded South Pole. Almost one month later, on January 18, Captain Scott and his team successfully reached the South Pole but found the claim marker the Norwegians had left. The Norwegians left the ice continent ahead of the British explorers and from Tasmania sent a telegram proclaiming to the world that they had found the South Pole. Scott and his crew, unfortunately, died from the harsh conditions and lack of food, while heading back to the coast. No humans set foot on the South Pole again until 1956.

From July 1957 to December 1958, 12 nations established over 60 polar stations in Antarctica. In 1959, the Antarctica Treaty was created by the nations having an interest in the continent. It outlined certain conditions in maintaining the natural environment, and



*A photo taken from space by NASA focuses directly on the South Pole on the continent of Antarctica.*



stated that the land could only be used for peaceful purposes. Nuclear testing was outlawed as well as dumping nuclear waste. By 1961, the terms of the treaty were made into international law, and since then, seven nations' claims of sovereignty of the Antarctic have been suspended. Dotted across the continent are polar stations; it is obvious that Antarctica has become a haven for explorers and scientists.

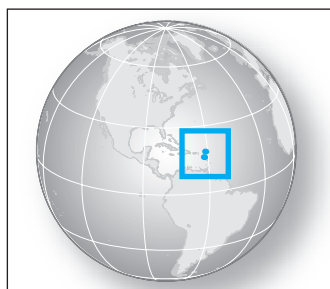
Antarctica remains a continent untouched by any industrial machine. However, the effects of overall global pollution are evident in the sky above. The ozone hole over the continent has expanded, and ice shelves have begun to disintegrate. In 1997, a Norwegian, Boerge Ousland, became the first person to cross Antarctica alone. The continent remains a mysterious and beautiful area for scientists conducting experiments and for explorers in testing their endurance in some of the harshest conditions on Earth.

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## Antigua and Barbuda

**Map Page** 1137 **Area** 173 square mi (443 square km)  
**Capital** Saint John's **Population** 67,897 **Highest Point** 1,326 ft (402 m) **Lowest Point** 0 m **GDP per capita** \$11,000 **Primary Natural Resources** pleasant tropical climate.



ANTIGUA WAS ONE of the primary British colonies in the CARIBBEAN SEA and remains a leader among the Leeward Islands (from the Virgin Islands to GUADELOUPE). Along with the nearby island of Barbuda, and the much smaller island of Redonda, Antigua became

independent in 1981 but retains close links with the UNITED KINGDOM (UK) and its commonwealth.

The islands are located in the northern part of the Lesser Antilles chain, approximately 80 km (50 mi) east of SAINT KITTS AND NEVIS, and the same distance north of the French island Guadeloupe. Unlike these neighbors, none of the three main islands are volcanic and mountainous but are low-lying coral and limestone formations. Antigua was one of the first islands encountered in the voyages of Christopher Columbus, who named it Santa María de la Antigua. The Spanish and French attempted to set up colonies but were discouraged by lack of fresh water and attacks by native Carib peoples. English planters established a permanent settlement in the 1630s and within a few decades had completely deforested the island, eradicated any native population, and repopulated it with large numbers of African slaves. The chief city, St. John's, was one of the region's most prosperous ports in the 18th century as a center for the sugar trade but declined after the abolition of slavery in 1834. Nelson's Dockyard, on the south side of the island, remains a testament to this prosperity and has been a national park since the 1980s. Sugar remained the island's major product until the 1960s but has now mostly disappeared.

Barbuda, 30 mi (48 km) to the north, was never developed as a commercial sugar producer, and it retains a separate identity from its larger, more populous partner, occasionally even voicing a desire for autonomy or independence from Antigua. Most of its 1,500 residents live in the only settlement, Codrington, named for Antigua's first major planter, who leased Barbuda to raise provisions and conduct slave-breeding experiments. Barbuda is also known among scuba divers and tourists for its numerous sunken ships and untouched reefs.

The tiny volcanic rock of Redonda, only .5 square mi (.8 square km), is located 35 mi (56 km) to the southwest of Antigua. It is populated only by goats, seabirds, and lizards but is the seat of the fabulous "Kingdom of Redonda," a literary-review group (mostly based in LONDON, England) established in the early 20th century.

The chief natural resource of Antigua and Barbuda is the climate: The tropical marine climate, perpetually sunny skies (bad for crops, good for tourism), and 365 white sandy beaches (one for each day of the year) make these islands one of the most popular tourist destinations. Together with historical settings and abundant duty-free shops in St. John's, the island's tourist



economy has given Antigua one of the highest per capita incomes in the Caribbean.

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## antipode

DURING THE TIME of Plato and Aristotle (circa 390 B.C.E.), the term *antipode* was used in reference to a natural balance thought to be sustained by the existence of a continent south of the equator, equal in size to the northern continent. Ptolemy (100–170 C.E.) described this southern landmass as Terra Australis Incognita (unknown southern lands).

In contemporary use, the term describes a point on the opposite side of Earth from another location. Antipodes are most often expressed as latitude/longitude coordinates. It is possible to compute the antipode for a given location by subtracting 180 from the location's longitude and changing latitude from degrees north to degrees south or vice versa. For example, the geographic center of TAIWAN is located at 121 degrees east longitude and 24 degrees north latitude. By subtracting 180 from 121 for a longitude of 59 degrees south and changing 24 degrees north to 24 degrees south, the antipode of Taiwan can be identified as being within the country of PARAGUAY in South America. Measured in great circle distance, antipodes are the farthest place on the world's surface from each other. A true circumnavigation of the world requires a traveler to pass through at least two points that are antipodean to each other. Some examples of true (antipodal) circumnavigations include Ferdinand MAGELLAN's 1522 expedition in his ship *Victoria* and Sir Francis Drake's 1580 journey in the *Golden Hind*.

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## Appalachian Mountains

THE APPALACHIAN Mountains of eastern North America comprise a north to south-trending range that extends for 1,600 mi (2,500 km) from the Gaspé Peninsula in Atlantic Maritime CANADA to northern ALABAMA in the UNITED STATES. Uplifted by the collision of continents ancestral to North America and Africa 270 million years ago, the Appalachian Mountains are the oldest mountain range in North America.

The Appalachian Mountains consist of a range of landforms from four physiographic provinces. The New England Province consists of rolling coastal lowlands and rugged interior highlands—like the White Mountains of NEW HAMPSHIRE and MAINE and the Green Mountains of VERMONT—of northern New England and Canada. The Ridge and Valley Province consists of long linear ridges separated by valleys with trellis drainage patterns. The valleys are rich in limestone that dissolves to produce sinkholes and underground caverns, producing KARST topography. The Ridge and Valley Province extends from NEW YORK to Alabama. The Blue Ridge Mountain Province extends from south-central PENNSYLVANIA to northern GEORGIA and is a rugged region of high relief with terrain that ranges from narrow ridges with steep slopes to broad mountains. The Appalachian Plateau (known as the Allegheny Plateau in the north and the Cumberland Plateau in the south) is a well-dissected plateau landscape with deeply eroded, dendritic drainage patterns. The Appalachian Plateau extends from New York to KENTUCKY. The northern Appalachian region from Canada to portions of northern Pennsylvania and NEW JERSEY was glaciated until 10,000 years B.C.E.

Elevation tends to increase from north to south in the Appalachian Mountains. In the north, the plateaus and low rounded mountains of the Gaspé Peninsula (the Shickshock Range) may exceed 4,000 ft (1,200 m) in elevation. Seven peaks in New Hampshire's Presidential Range exceed 5,000 ft (1,500 m). Mount Washington, at 6,288 ft (1,886 m), is the second-highest Appalachian peak. Elevation decreases somewhat in the central Appalachians, where ridges and peaks—like the Allegheny Mountains in Pennsylvania and VIRGINIA—generally average 3,000 ft (900 m). Elevations over 5,000 ft (1,500 m) begin in the Blue Ridge Mountains of southwestern Virginia, like Mt. Rogers at 5,729 ft (1,718 m) and Pine Mountain at 1,658 m (5,526 ft) and eventually exceed 5,526 ft (1,800 m) in the Great Smoky Mountains of eastern TENNESSEE and western NORTH CAROLINA. The highest peak in the Ap-



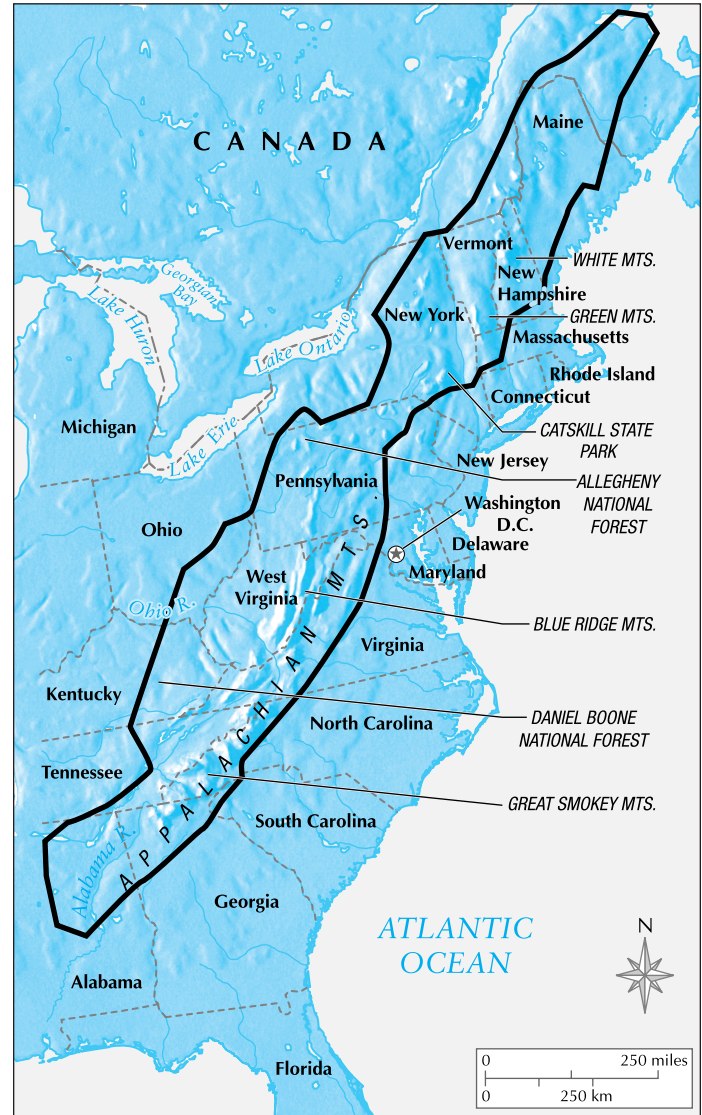
palachians (and the eastern United States) is Mt. Mitchell in the Black Mountains of North Carolina at 6,684 ft (2,037 m).

The climate of the Appalachian Mountains varies with latitude and elevation. Average annual temperature for Canada's Gaspé Peninsula is approximately 38 degrees F (3 degrees C). Annual precipitation averages 35 in (89 cm) in inland areas but may exceed 58 in (147 cm) along the coast. In the central and southern Appalachians, average annual temperatures may range from 50 to 64 degrees F (10 to 18 degrees C), respectively. Average annual precipitation ranges from 35 in (89 cm) in valleys of the central Appalachians to over 78 in (198 cm) in the high peaks of the southern Appalachians, the highest precipitation in the eastern United States.

The biological diversity of the Appalachian Mountains is rich and diverse, a product of varied climate, topography, and glacial history. In the Gaspé Peninsula and the high peaks of the Presidential Range, the summits are treeless and the vegetation is alpine, dominated by low-stature perennial herbs, shrubs, and graminoids and numerous lichens and mosses. Boreal species such as caribou occur in Canada's Shickshock Range and historically occurred in northern New England. Northern Appalachian forests include spruce-fir forests dominated by balsam-fir and red spruce and northern hardwood forests dominated by sugar maple, American beech, and yellow birch. Oak forests, dominated by northern red oak and white oak, become more common in the central Appalachians, particularly on drier slopes. The species-rich mixed mesophytic forest, with over 158 tree species, reaches its greatest development in the southern Appalachians. The southern Appalachians are also the world's center of diversity for the lungless salamanders, harboring 54 species. Many boreal species, like the northern flying squirrel and red spruce, also occur at high elevations in the southern Appalachians, relict survivors of the glaciation that drove them southward.

The Appalachian Mountains are rich in natural resources, particularly minerals and forest products. Coal, both anthracite and bituminous, is abundant in the Appalachians, particularly in the Appalachian Plateau, where oil and gas production is also centered. Limestone is quarried in the karst landscapes of the Ridge and Valley.

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*The Appalachian Mountains are the oldest range in North America, extending from Canada to the southern United States.*

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## aquifer

AN AQUIFER IS a subsurface structure or formation that provides a sufficiently permeable condition to yield significant quantities of water to wells and springs. Soil water movement is determined by two factors: porosity, which is the ability to hold on to water particles, and permeability, which is concerned with movement. The word *aquifer* comes from two Latin words: *aqua*, or “water,” and *ferre*, “to bear or carry.” Aquifers literally carry water underground.

Precipitation or meteoric water migrates its way downward through the pores or cracks in the soil. Beneath the soil surface is the zone of aeration in which the smaller openings contain a little water and the larger spaces usually contain air. Often soil particles are thinly covered with hygroscopic water, while capillary water is held close to the surface for plant needs. Excess water will infiltrate by gravity to a point where all the spaces are filled with groundwater, which begins the zone of saturation. The top of this layer is called the water table and it will fluctuate depending upon precipitation or draw down.

Aquifers are moderately to highly permeable layers of rock in which groundwater is stored or through which it moves. The formation may be a layer of gravel or sand, a layer of sandstone or cavernous limestone, a rubbly top or base of lava flow, or even granite fractured by ancient ice sheets. Some rock, such as clay or solid granite, may have only a few hairline cracks through which water can move, making them poor aquifers. In terms of storage at any one given time, groundwater is the largest single supply of fresh water available for use. It is estimated that it is more than 30 times greater than all the water stored in streams, rivers and freshwater lakes, yet most of it is not easily accessible. The largest aquifer in the UNITED STATES is the Ogallala, which underlies the land from SOUTH DAKOTA to northern TEXAS.

Rainwater that migrates downward directly to the water table creates an unconfined aquifer, which may be shallow and therefore susceptible to contamination from industrial landfills, agricultural chemical runoff, sewer leakage, faulty septic tank operation, or even salt-water intrusion in coastal areas. A confined aquifer occurs when water is stored beneath a blocking stratum or aquiclude that stops the direct movement of gravitational water to it, allowing water to migrate over long distances, taking years or even centuries.

The quality of groundwater is determined by the depth of the aquifer as bacterial or human pollution

can be screened out by the rocks and soil. Water from a confined aquifer will tend to be freer of dangerous materials.

However, water is a solvent and may also have dissolved minerals. The most likely of these are sodium, calcium, magnesium, potassium, chloride, bicarbonate and sulfate, which are picked up in its movement. Water typically is not considered desirable for drinking if the quantity of dissolved minerals exceeds 1,000 milligrams per liter. Water that is pumped or released from a confined aquifer will rise to a level called the piezomatic surface, which is dictated by the pressure. When pressure forces flowing water to the surface, it is called an artesian well. The largest of these formations is Australia's Great Artesian Basin.

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## Arab geographers

IN THE MIDDLE AGES, the Arabs, inspired by Mohammed's faith, conquered the FERTILE CRESCENT, North Africa, southern SPAIN, and much of Central Asia, including IRAN and AFGHANISTAN. Arriving from the deserts of Arabia with a rich linguistic tradition but few material possessions, they soon were introduced to the ancient thought of INDIA, Persia, and GREECE. Within a century, the philosophy and sciences of these older civilizations were translated into Arabic, making it possible for books to be read from Spain to India. In addition, soldiers, sailors, merchants, and travelers from Spain to CHINA were to add information that developed Arab geography. Included in the medieval Islamic reception of these older scientific teachings were the works of geographers. Greek thought called the description of the Earth's features, with the location of people and living things, *geographia*. It was a combination of natural philosophy (science still not differentiated from more speculative philosophical ideas), astronomy, histories, cartography, and travel reports.



Many Greek thinkers, from the pre-Socratic philosophers to the great Hellenistic writers, had contributed to *geographia*, as it was received by the Arab geographers. These included Homer, Anaximander of Miletus, Xenophon, Herodotus, Arrian, Plato, Aristotle, and many others. The main contributors all wrote books specifically about geography. Eratosthenes, the librarian at Alexandria (Egypt), wrote a *geographia* and contributed the use of meridian lines. Poseidonius of Rhodes wrote a geography and accurately calculated the size of the Earth. Strabo wrote *Geographica* to describe in many volumes the MEDITERRANEAN SEA, its adjacent lands, and more. Claudius PTOLEMY, a Greco-Egyptian, wrote *Guide to Geography*. It was the most scientific and thorough geography work of ancient times. He located places with longitude and latitude, discussed mapmaking, and generally summarized Greek geographic knowledge at the peak of Roman power. Ptolemy's *geographia* was the resource for geographers until the Renaissance.

While the Arab geographers wrote in Arabic, many were not Arabs, but from ethnic groups that had converted to Islam. The Arab geographers included historians, astronomers, government officials such as postmasters, intelligence officers, travelers, as well as geographers. They were stimulated to study geography by the vast reaches of the Islamic world, the duty of the hajj, political control, and the great volume of commerce carried on caravans and in ships.

### IBN KHURRADADHEBEH

The first of the Arab geographers whose work is still extant was a Persian, Ibn Khurradadhebeh (circa 800s). Writing in Arabic, he was in charge of a postal system and an intelligence service. His geographical descriptions of the Islamic world and beyond were extensive. Other Arab geographers of the time were Ibn al-Faqih (d. 903) and Ibn Rusteh (d. 910), who also wrote descriptively of what could be known of the world and its peoples. Other geographers wrote in the 900s, including Mas'udi (d. 956). He described people like the Slavs, Lombards, and others from travelers' reports. He apparently used the work of al-Hakam, the emir of Cordova.

The Galkhi geography school included a number of notable Arab geographers. Among these were Ibn Hawqal and Abu Ishaq al-Istakhri. They divided the world of Islam (Dar al-Islam) into 20 categories. The world outside they put into the "house of war" (Dar al-Harab), as a separate category. They used both the older geographic knowledge and materials from the



Much of Arab geography stemmed from the need to locate the holy site of Mecca (above) from any direction.

Koran and the hadiths. Other schools, such as the Ikhwan al-Safa and the Ishraqi, described the world in zones and found symbolic meanings in "sacred geography" when concerned with holy cities like Jerusalem and Mecca.

Al-Muqaddasi (d. 1000) wrote a compendium of the physical and human geography of the known world. He based his geography on his own observations and those of dependable witnesses. Much of the information in the work of Ibn al-Faqih was cited by Al-Yaqut (d. 1229), who composed a geographical dictionary. Both were relying in part on the report of Harun ibn Yahya, who had been a prisoner in Rome around 886. In the late 900s, Aby Rayhan al-Biruni (973–1048) (born in Khwarazm, near the Aral Sea) wrote a number of short scientific works. His *Cartography*, showing map projections, is still extant.

The *Reconquista* and the Crusades brought increased contacts with the non-Muslim world, stimulating geographers such as Zuhri to write about Europeans. Others, such as the Persian Zakariya ibn Muhammad al-Qazvini (d.1283), used the work of earlier geographers like Ibn Ya'qub.

### AL-IDRIS

The greatest of the Arab geographers was Al-Idris (1100–1165). Abu 'Abd Allah Muhammad al-Idrisi is

often called ash-Sharif al-Idrisi. He was probably the greatest of all the medieval Arab geographers. Al-Idris was born at Sabtah, (Cueta) in North Africa in 1100. He studied at Cordoba, lived at Marrakesh for a while, and then traveled in North Africa during his youth. He may also have traveled some in Europe as well.

About the year 1145, al-Idris entered the service of Roger II of Sicily. Roger II was a Norman Christian king; however, al-Idris remained a Muslim. He continued at the Roger court as the royal geographer for the remainder of his life. It is likely that al-Idris stayed in Sicily to escape persecution. He was a Hummudid descendant and therefore a political threat as a legitimate claimant to the caliphate. Some Western scholars believe that al-Idrisi may have been seen as a renegade by other Muslims, because Muslim biographers wrote little about him after he joined Roger's court.

Al-Idris was a scientist, a geographer, and a map-maker. He wrote three major geographical works. One of them is the greatest of all medieval geographical treatises. In addition, he is believed to have written literary and medical volumes. During al-Idrisi's career in Sicily, he completed three major geographical works. Perhaps the most amazing was a silver planisphere on which was depicted a map of the world. The silver planisphere has been lost, but his maps and book have survived.

The second major work Al-Idris created was a world map. It consisted of 70 sections. The sections were formed by dividing the Earth north of the equator into seven climactic zones of equal width. Then each of the climactic zones was subdivided into ten equal parts by lines of longitude.

Al-Idris wrote a geographical text intended as a key to the planisphere. This was his great *al-mushtaq fi ikhtiraq al-afaq* (*The Pleasure Excursion of One Who Is Eager to Traverse the Regions of the World*) and which also is known as *Kitab Rujar* or *al-Kitab ar Rujari* (*The Book of Roger*).

The *Kitab Rujar* was a blend of empirical and rational methods. Like the Scholastics, he used materials from earlier Arabic and Greek geographical works. But this was combined with empirical information obtained through eyewitness reports. To get firsthand observation, al-Idris sent a group of people with training in geography and skill in drawing to a number of countries to record their observations.

Other geographical works are attributed to al-Idrisi, including one (now lost) written for William I (William the Bad), Roger's son and successor who reigned from 1154 to 1166, as well as several critical

revisions and abridgments. Al-Idrisi's scientific interests embraced medical matters as well geography. His *Kitab al-adwiya al-mufradad* (*Book of Simple Drugs*) lists the names of many drugs in as many as 12 languages, thereby giving a geopharmacology. He died in 1165 or 1166, but whether in Sicily or in his birthplace, Sabtah, is undetermined.

Geographers who came after Al-Idris were Ibn 'Abd al-Mun'im and Ibn Sa'id al (1210–74). The latter wrote *World Geography* in Spain, where he lived.

Ibn Battuta (d. 1377) was a devoted traveler who described vast areas of the Islamic world and Southeast Asia. Other travelers recorded the physical, human, and natural geography of the Islamic world as well as the routes of trade and travel. Among the historical contributors was Ibn Khaldun (1332–1404), who wrote the famous *Al-Muqaddimah*. It is an important book in the development of accurate history, and the opening chapters are an extensive geographical description of the peoples of the world.

Other geographers were concerned with specific aspects of geography. Qutb al-Din wrote a treatise on geometry and is included in the Maraghah school. He worked with the problem of classified knowledge. He organized such knowledge as philosophical (*al-hikmi*) and nonphilosophical (*ghayr al-hikmi*). Geography was in the latter category as nonreligious and non-philosophical (*ghayr al-diniy*).

A significant problem for Arab geographers was to find the direction of Mecca in order to face toward it. The direction is marked in a mosque by a qibla. To properly position it was a problem of mathematical geography that had to be solved. Often geometry merged with astronomy. Various methods were developed, but by the 10th century, tables had been developed that would locate the qibla as a function of geographic longitude and latitude. Others, like al-Biruni, working in India and elsewhere, attempted calculations on the size of the Earth.

The rise of the Ottoman Empire and other centers of Islam in the East shifted geographic writing into Turkish and Persian regions after the mid-1400s.

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## Arabian Sea

THE ARABIAN SEA covers approximately 1,491,000 square mi (3,862,000 square km) and is located between the Arabian and Indian peninsulas in the northwestern area of the INDIAN OCEAN, bounded by INDIA, PAKISTAN, IRAN, OMAN, YEMEN, and the HORN OF AFRICA. The Arabian Sea has been the historic trade route from Occident to Orient since the dawn of commerce between the cradles of civilization. Dhows (sailing vessels) full of spices and slaves have given way to petroleum tankers and container ships, yet the trade continues unabated.

As early as the 8th century and onward, Arabian and Persian mariners learned to navigate this area by using prevailing winds and the surface currents generated by the summer and winter monsoons. For half the year (April–October), the winds in this region are from the southwest, reversing in the other half of the year. This monsoon (season) weather pattern dominates the region on land and sea, setting the pace of commercial activities and much of life.

Commercial fishing is a major activity in the Arabian Sea with the leading species fished being sardines, prawns, and mackerel. India accounts for 23.6 percent of its annual haul mostly from waters 6 to 9 mi (10 to 15 km) from the coast. Fishing stocks are being depleted because of a combination of overfishing and pollution along the Indian coast. Some 65 percent of all fish taken from the Arabian Sea continues to be from local fishermen in traditional boats as their single means of livelihood.

The overexploitation of fish stocks is mostly due to large fishing vessels operating illegally near the coast. The growth of regional populations, particularly India, will add pressure on the already challenged marine resources. This population increase and industrial devel-

opment create major pollution problems. Industrial effluents contain heavy metals and chemical wastes. Pesticides and organic wastes flow untreated into the coastal waters from cities and agricultural land. Oil pollution from accidents and ballast dumping is on the increase. The nations that share the management and use of the Arabian Sea have no comprehensive plan for conservation and management of the resources or uses of this critical area of ocean.

Primary branches of the Arabian Sea are the Gulf of Oman, which joins it to the Persian Gulf via the Strait of Hormuz and the Gulf of Aden, which joins it with the Red Sea via the BAB EL MANDEB. There are no islands in the middle of the Arabian Sea, where depths average in excess of 9,800 ft (3,000 m). Deep water reaches close to the bordering lands except in the northeast, off Pakistan and India. The deepest known point in the Arabian Sea is at Wheatley Deep, where depths are more than 19,000 ft (5,800 m). The principal waterway draining directly into the Arabian Sea is the INDUS RIVER. Coastal islands exist around the Arabian Sea and have proven significant for political and military purposes.

The sea is of geostrategic interest as it is the transit route for a major portion of the world's oil supply. In addition, the commerce flowing by ship from Asia to Europe also sails this sea.

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## Aral Sea

THE ARAL SEA (Aral'skoye More) is one of the world's largest lakes or inland seas. It is located to the east of the CASPIAN SEA in the Central Asian republics of Kazakhstan and Uzbekistan. The region is arid, with the Karakum Desert lying to the west of the Aral Sea and the Kyzylkum Desert to the east. The sea is shallow with no outlet; the water level is determined by the balance between loss from evaporation, input from rivers, groundwater, and precipitation. Its main source of water is two rivers: the Syr Darya (the ancient River

Jaxartes) and the AMU DARYA (the ancient River Oxus), which rise in the foothills of the northern HIMALAYAN mountains.

During the last 3 million years, the lake has periodically flooded and experienced episodes of desiccation as the Earth has cooled and warmed. Recent changes are, however, the result of human activity, and the sea now has a negative water balance; that is, there is a net loss of water annually. This is mainly because the Amu Darya and Syr Darya are subject to considerable water extraction for irrigation. Consequently, the Aral Sea has shrunk in size, especially in the last 70 years as cotton production in Central Asia has intensified. Even in the last 40 years, the area of the Aral Sea has decreased by about 50 percent and its level has dropped by more than 56 ft (17 m). Almost 19.8 million acres (8 million hectares) of land in the region are now under irrigation, compared with only 7.4 million acres (2.9 million hectares) in 1900 and 12.4 million acres (5 million hectares) in 1960. Moreover, much irrigation is inefficient as water loss from the canal network is high through exposure of a large surface area of water that encourages evaporation. The Aral Sea is no longer one water body; its volume has decreased by two-thirds and since 2001 there have been three water bodies. The shoreline has decreased by 300 mi (480 km), isolating settlements from the water's edge in salt desert.

Water quality has also altered as salinity and mineral content have increased, and wind-blown sediment is a problem. Fish and wildlife losses have ensued and no commercial fishing is possible; vegetation cover has diminished as fewer species can tolerate the harsh environment. Livelihoods based on fishing and hunting have disappeared.

Human health problems have also developed, partly because of poor water quality attributed to contamination with agricultural chemicals. Average life expectancy is only about 40 years, the rate of infant mortality is three to eight times higher than that in the United States, and rates of miscarriage are high, as are incidences of viral hepatitis and tuberculosis. Inevitably, there is rapid depopulation because of these adverse conditions. Since the demise of the Soviet Union, cotton production has declined but without much difference in water extraction. The outlook is not encouraging. The exploitation of oil and gas reserves in the region may exacerbate an already acute environmental situation.

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## Arctic Circle

LOCATED AT 66.5 degrees north latitude or 23.5 degrees southward of the North Pole, the Arctic Circle forms an imaginary line marking the northernmost location where the sun can be seen during the northern hemisphere's winter solstice (December 21). On June 22 and again on December 21, the circle of illumination (formed by the sun's rays striking the Earth) extends from the edge of the Arctic Circle in the north to the ANTARCTIC CIRCLE in the south.

On December 21, the sun is directly overhead at the TROPIC OF CAPRICORN (23.5 degrees south latitude) and the area within the Arctic Circle experiences 24 hours of darkness. On June 22, the sun is directly overhead at the TROPIC OF CANCER (23.5 degrees north latitude) and the area within the Arctic Circle experiences 24 hours of sunlight. On this day, the sun reaches its zenith (highest point) of 47 degrees above the horizon at noon and its nadir (lowest point) at midnight. Long periods of continuous sunlight during summer months have led to the area within the Arctic Circle being called "Land of the Midnight Sun."

The name *Arctic* comes from the Greek *arktos* meaning "bear," in reference to the position below the Great Bear constellation (Ursa Major). Located within the Arctic Circle are the ARCTIC OCEAN, the northern portion of GREENLAND, Baffin Island and the far northern parts of EUROPE, RUSSIA, ALASKA, and CANADA.

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## Arctic National Wildlife Refuge

LOCATED IN northeastern ALASKA and managed by the U.S. Fish and Wildlife Service, the Arctic National

Wildlife Refuge (ANWR) encompasses the largest diversity of wildlife of any protected area in the circumpolar north, earning it the nickname “the American Serengeti.” Efforts to preserve the refuge began in 1960 with the establishment of the Arctic National Wildlife Range.

Following passage of the Alaskan Lands Act in 1980, the area was renamed the Arctic National Wildlife Refuge and its size expanded to 20 million acres (8 million hectares), approximately the size of SOUTH CAROLINA. Included within the refuge are 8 million acres (3 million hectares) of wilderness land.

The ANWR is bounded to the east by CANADA and to the north by the Beaufort Sea. At its seaward margin is the flat and treeless Arctic coastal plain, extending inland for 40 mi (64 km). To the south of the coastal plains is the Brooks Range, an east-west band of mountains with several 9,000-ft (2,750-m) peaks. The rugged glacial topography of the range is interspersed with ice fields and wide, steep-sided valleys. An active layer of permafrost, or permanently frozen soil, is found in most areas of the refuge. Permafrost extends downward to an average of 1,000 ft (300 m). Some permafrost areas are underlain with patterned ground formed by polygons measuring 30 to 200 ft (9 to 61 m) in diameter. The shape of polygons is influenced by spring meltwater seeping into surface cracks and freezing.

The climate of the coastal plain is classified as Arctic or sub-Arctic with cool, cloudy summers. The average July temperature is 41 degrees F (5 degrees C) and maximum temperatures rarely exceed 86 degrees F (30 degrees C). Winters are extremely cold, with February averaging -4 degrees F (-20 degrees C). High surface winds can result in windchill factors well below ambient temperatures. The Arctic plain receives an average of less than 10 in (25 cm) of precipitation. Two major biomes dominate the refuge: a northern boreal forest lying on the southern slope of the Brooks Range and Arctic tundra on the north slope. The ANWR has wildlife species common to the Arctic and sub-Arctic. More than 36 species of fish and nine marine mammals are represented in the refuge. Open range provides unconfined areas for large herds of porcupine caribou that migrate 800 mi (1,280 km) in May and June to ancestral calving areas on the coastal plain. In early July, they return to wintering areas to the south of the Brooks Range. Dall sheep can be found on mountain-sides and musk oxen near water sources on coastal plains. Polar bears move onshore during the winter and return to sea ice in the spring months to hunt seals.

Other ANWR mammals include lynx, voles, lemmings, and wolves. Proposals for petroleum drilling within the coastal plain have created controversy with regard to impacts on caribou and other wildlife in this Arctic region.

Bird nesting takes place between April and July. Represented within the refuge are the golden eagle, peregrine falcon, sandpiper, and plover. Migratory ducks and shorebirds begin collecting in lakes and lagoons in July to prepare for their migration to wintering areas in South America, Africa, Asia and the lower 48 U.S. states. Ptarmigan, dippers, and gyrfalcons are among the few species that remain in the refuge during the long Arctic winter.

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## Arctic Ocean

THE ARCTIC is the smallest and shallowest of the Earth’s five oceans, occupying 4 percent of the world’s ocean space and surrounding the North Pole, the northernmost locale on the planet. The waters of the Arctic are fairly equidistant around the area, making the North Pole the approximate center of the ocean.

The majority of the Arctic Ocean is found north of the ARCTIC CIRCLE, which is one of the five circles of latitude marked on maps. Everything north of this line is considered the Arctic region; this area is mostly water, but the northernmost parts of ALASKA, CANADA, RUSSIA, NORWAY, and a significant portion of GREENLAND are within its borders. Therefore, most—but not all—of the Arctic Circle is ocean; and most—but not all—of the Arctic Ocean is north of the Arctic Circle.

Greek explorers of the late 300s B.C.E. discovered this ocean, with Pytheas reporting frozen waters located six days north of Britain. Ancient Greeks named these waters after the Arktos constellation found in extreme northern skies, a cluster of stars now known as Ursa Major or Great Bear.

The average depth is 3,407 ft (1,038 m) and its deepest point north of Svalbard, Norway, is 17,881 ft (5,450 m). Although some of the ocean is not deep at







all, the lowest point, Fram Basin, is -15,305 (-4,665 m) below sea level.

The lowest surface temperatures of the Arctic Ocean occur in February at -28 degrees F (-33 degrees C) and the highest in July at 29 degrees F (-2 degrees C); frozen precipitation averages 10 in (25 cm) annually and rarely melts. Because of constant cold, the central surface of the Arctic Ocean is covered with ice 10 ft (3 m) thick, and some ice can triple that thickness. During summer months, free-flowing water surrounds the ice; during the winter, ice thickness doubles and even extends to land adjacent to the ocean. Around June 22, the sun can still be seen on the horizon at midnight. This gives the region its nickname: Land of the Midnight Sun.

The Arctic connects with the ATLANTIC OCEAN by Greenland, and the Bering Strait merges the Arctic with the Pacific. The PACIFIC OCEAN is more than 13 times the size of the Arctic, but even the world's smallest ocean is 5,440,000 square mi (14 million square km), with a coastline of 28,203 mi (45,389 km), making the Arctic nearly 1.5 times the size of the UNITED STATES. Two significant waterways also connect to the ocean: the Northwest Passage, which flows into the United States and Canada; and the Northern Sea Route, which provides water to Norway and Russia.

The Arctic contains five continental shelves, which are areas of shallow, submerged land located along the edge of a coastline. When a continental shelf ends, there is generally a steep slope that descends into the largest portion of the ocean floor. One of these, the 900-mi (1,448-km) Siberian Shelf, is the largest continental shelf in the world; approximately 50 percent of the Arctic Ocean's floor consists of this geological feature. An underwater ocean ridge divides the Arctic into two basins.

Much of this ocean contains icebergs, frozen waters broken off from glaciers formed on the land. Some, especially those that form on Ellesmere Island and then break off (calve) into the Chukchi Sea, are large enough to be considered ice islands and last for several years. Once the icebergs hit the relatively warmer waters of the northern Atlantic, however, they melt fairly quickly. Few icebergs hit the Pacific, blocked from proceeding by the Bering Strait.

Fish, seals, walruses, and whales reside in these waters, and petroleum and natural gas is pumped out. The Arctic is also home to the only ocean bear on the planet. Because of the extreme cold and low sunlight in this region, this ocean is slow to adapt to or recover from environmental change; scientists are watching the

thinning of its polar ice and debating the connection between global warming and the shrinkage.

This region also provides scientists with information about pollution. Since it generates little of its own contaminants, the increase of pollutants found in the area help measure the world's increasing water and airborne toxicity.

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## Argentina

**Map Page** 1141 **Area** 1,068,302 square mi (2,766,890 square km) **Capital** Buenos Aires **Population** 39,144,753 **Highest Point** 22,834 ft (6,960 m) **Lowest Point** -344 ft (-105 m) **GDP per capita** \$11,200 **Primary Natural Resources** iron ore, petroleum, uranium.



ARGENTINA IS A COUNTRY located in southern South America, the second-largest country on the continent. Argentina shares a long border with CHILE to the west. The two countries have disputed territory around the Beagle Channel in Tierra del Fuego. Argentina also borders on URUGUAY, PARAGUAY, BRAZIL, and BOLIVIA.

The country possesses a nearly 3,100-mi- (5,000-km-) long coastline on the ATLANTIC OCEAN. Argentine claims over the Islas Malvinas, or FALKLAND ISLANDS, has led to a dispute with Great Britain, which also claims the islands. The two countries fought a war over the Malvinas/Falklands in 1982, when the Argentina military invaded the islands. After a short but costly conflict, the British forcibly retook control of the islands.

Argentina can be divided into four main geographic regions: the ANDES, the North, the Pampas, and Patagonia.

The Andes Mountains form the “backbone” of Argentina along the western border with Chile. In the northern Andes, peaks average between 11,000 and 13,000 ft (3,353 and 3,962 m), although some can reach as high as 19,000 ft (5,791 m). There are a number of valleys in the north, including the broad quebradas that historically provided access to the Atlantic. There has been some mining in the northern Argentine Andes, including lead, zinc, copper, silver, and beryllium. As the Andes make their way south, the range narrows and the peaks get higher. Some of the highest mountains in the world can be found in the Central Argentine Andes. Among these high peaks is ACONCAGUA MOUNTAIN, the highest mountain in the Western Hemisphere at 22,834 ft.

### NORTHERN ARGENTINA

The northern part of the country can be divided into two parts: the Chaco region and the so-called Mesopotamia area. The Chaco is a large alluvial plain that stretches over territory in Argentina, Paraguay, Brazil, and Bolivia. The soil is made up of deposits that wash down from the Andes Mountains. The Chaco region is subject to major flooding during the summer rainy season. Much of the Chaco consists of woodlands of deciduous scrub trees that often grow densely packed together. There are also areas of grassy savannahs.

A subtropical climate and some of the highest temperatures in Latin America lead to rapid evaporation, which makes agriculture difficult without irrigation. These difficult physical conditions limited the agriculture practiced by the native inhabitants. Historically, the economy of the Chaco region depended on the *quebracho* forests, which provided a source of tannin used for the early Argentina leather industry. Many settlers moved to the region in the 19th century to exploit these forests after the defeat of the native peoples in the 1880s. In the 1930s, more settlers were attracted to the Chaco by cotton, which could withstand the sometimes long drought period in the region.

The Mesopotamia region, so named because of its location between the Paraná and Uruguay Rivers, includes the western Paraná plateau and a large lowland. Iguacu Falls is located in the region along the border with Brazil and Paraguay. Spanish settlers came to the region starting in the sixteenth century.

In the 17th century, Jesuit missionaries arrived in the area, giving the region the name of Misiones. Misiones is the center of production for yerba mate, used to make a tealike beverage. The Mesopotamia region

also possesses some excellent grazing land for cattle and sheep.

The plains area known as the Pampas is the heartland of Argentina. Historically, it has been the demographic, economic, political, and cultural center of the country. During the Spanish colonial period, the Pampas were an area of open grasslands with wild herds of horses and cattle derived from the animals that European settlers brought. The region's fertile soil has made agriculture easy and profitable. By the 19th century, ranching and grain farming dominated the Pampas. Wheat has been the key crop of the Pampas, although corn, barley, and flax have also been successfully grown. Traditionally, the Pampas was divided into large estates known in Argentina as *estancias*. The Pampas accounts for about 8 percent of the country's agricultural production.

Some 70 percent of the Argentine population resides in the Pampas region. Buenos Aires, the country's largest city and Argentina's capital, is located in there. Buenos Aires has long been the country's commercial and manufacturing center. It serves as the main port along the Río de la Plata. In the 19th century, the advent of the railroad connected the city with the surrounding Pampas, bringing agricultural products to the port quickly and cheaply. Other major cities in the region include Rosario, Córdoba, and Mar del Plata. In addition to being the demographic center of the country, the Pampas region is home to more than 80 percent of Argentina's industry.

The southern lowlands of South America south of the Colorado River are known as Patagonia. The region consists mostly of cool, arid, and windswept STEPPES. The climate of Patagonia is generally mild. Inland and to the south, there are moister, more productive grasslands that can be used for grazing. However, much of the region is desert, with rainfall under ten inches annually. The lack of rainfall is due to the barrier created by the Andes Mountains and the Falkland Current.

Patagonia was unsettled by Europeans until the second half of the 19th century. In the 1860s, immigrants from Wales settled along the Chubut River. After the “Conquest of the Desert” in the 1880s, when the Argentine government militarily subdued the Native Americans in Patagonia, Argentine and European settlers moved into the region. The wave of migrants led to the establishment of large sheep ranches in Patagonia. Other economic activities included fruit orchards, vineyards, dairy farms, and coal mining. In the early 20th century, petroleum became an important re-

source in the region and led to the creation of Comodoro Rivadavia, which serves as the center of Argentina oil production.

The region is sparsely populated. Patagonia accounts for about one-fourth of the country's land but possesses only about 1 percent of the population. The most developed part of Patagonia is in the north, close to the Pampas. The principal city in the region is Neuquén, located in the upper Río Negro Valley. The southern part of Patagonia is much less developed. Ushuaia is the southernmost town in the world.

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## Arizona

A PLACE OF indisputable geographical interest in the U.S. Southwest, of which the GRAND CANYON of the Colorado River is but the leading example, Arizona currently exemplifies a trend toward urbanization in western states. While much of Arizona's land area of 113,635 square mi (294,315 square km) remains undeveloped, Arizona's capital and largest city, Phoenix, alone accounts for more than a quarter of the state's total population of 5,130,632 (2000 U. S. census).

Arizona was the last of the contiguous UNITED STATES to be granted statehood, in 1912. Statehood followed a long territorial history, beginning with the combination of a portion of the land area ceded to the United States by MEXICO in 1848 and the Gadsden Purchase of 1853 in the Territory of New Mexico. Arizona was organized as a separate territory in 1863. The state is bounded by UTAH, NEW MEXICO, CALIFORNIA, and NEVADA, and by Mexico to the south. The propriety of including the extreme northwestern land area, known as the Arizona strip, has long been a matter of dispute with adjoining Utah, due to its relative inaccessibility from greater Arizona across the Colorado River.

Three physiographic provinces divide the state into a continuity of diverse regions. To the north, the Colorado Plateau Province rises to a maximum altitude at

Humphreys Peak (12,633 ft or 3,851 m). Composed primarily of Paleozoic sedimentary strata, the plateau is joined from several interlocking uplifted blocks, terminating on the southern boundary at the Mogollon Rim. The Grand Canyon cuts through the southwestern corner of the plateau, exposing a vast geological column that terminates in pre-Cambrian gneiss at the level of the Colorado River. Volcanic activity, seen in a field of cinder cones to the south of the canyon, has been recent; Sunset Crater, a cinder cone northeast of Flagstaff, is less than 1,000 years old. South of the Mogollon Rim are the Central Highlands, a province that is also termed the Transition Zone because the province shares characteristics of the Colorado Plateau and of the Basin and Range to the south and west. The southern and western extents of Arizona are the Basin and Range Province, a region of mountain ranges composed of volcanic rocks, separated by deep grabbens choked with alluvium.

Most of the Basin and Range Province is arid and is classified as desert. The SONORAN DESERT, which dominates the province and continues into Mexico and California, has two seasons of rainfall—in summer and winter—in its central portion, known as the Arizona Upland. This biannual rainfall provides up to ten inches of precipitation annually, making the Arizona Upland the most lush of American desert landscapes. Its unique plants include the saguaro, a columnar cactus that can reach 50 ft (15 m) in height. High temperatures in summer easily reach into the 110s degrees F (40s degrees C) in portions of the region. Because of its altitude, the Colorado Plateau enjoys a more moderate climate, although it too is arid. In a swath that crosses the Grand Canyon and extends along the Mogollon Rim above 6,000 ft (1,800 m), ponderosa pine form the largest continuous forest of this species in the United States. Winter snowfall is common on the plateau but can occur throughout the state, infrequently in the mountains surrounding Tucson in the south.

## HUMAN GEOGRAPHY

Humans have had a presence within the state's boundaries for more than 10,000 years, and relatively arid conditions have preserved "soft" artifacts from much of that range in time. Evidence of permanent and semi-permanent settlements, dependent in part on agriculture, begins appearing in the archaeological record about 2000 B.C.E. From these roots, two great civilizations with urban centers, the Puebloan (often called Anasazi) on the Colorado Plateau and the Hohokam in

the Sonoran Desert, arose to exploit the region's resources. Both of these civilizations dispersed from urban centers around 1400, following periods of civil strife, decreasing annual rainfall, and the expansion of the Dine (Navajo) and Apache from the north. Descendants of Puebloans include the Hopi; the Hohokam left descendants among the Pima, Maricopa, and Tohono O'odham.

Although the Spanish perfunctorily explored the region after the conquest of Mexico, the inhospitable landscape combined with resistance from native peoples stopped Spanish colonization at Tucson. Further incursions of Euro-Americans did not occur until Anglo-Americans began to exploit the region's mineral resources, which included silver and copper; marginal grazing lands; and timber in the 19th century. Agriculture had a lesser place in the region's territorial economy until after 1911, when the Roosevelt Dam on the Salt River opened the desert around and south of Phoenix to dependable irrigation for cotton and other crops. Improvements in transportation and air-conditioning technology, following World War II, drove a real estate boom and led to a rise in Arizona's population and a diverse and technologically modern economy.

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## Arkansas

**ITS NAME DERIVED** from a French-adapted Native American term meaning "downstream people," Arkansas is the 27th largest state at 53,104 square mi (137,539 square km). The state's shape is almost like a box, as its north-south extent is 240 mi (386 km) and the east-west extent is 275 mi (443 km).

Located in the mid-Southwest UNITED STATES, landlocked Arkansas is bordered by six other states: MIS-

SOURI, TENNESSEE, MISSISSIPPI, LOUISIANA, TEXAS, and OKLAHOMA.

The longest river in Arkansas is the White River, a tributary of the MISSISSIPPI, running 1,485 mi (2,388 km) to the southeast. The largest lake in the state is an artificial one, Lake Ouachita (60 square mi or 155 square km), located in the middle west of the state. The largest natural lake in the state is Lake Chicot, which is an oxbow of the Mississippi in southeast Arkansas.

There are several distinct physical regions of Arkansas. In the northwest are the highlands of the heavily forested Ozark Plateau and Boston Mountains. South of this area is the Ouachita Mountain range, which includes the highest peak in Arkansas, Magazine Mountain, at 2,753 ft (839 m). The rest of the land in Arkansas is mainly lowlands of the Mississippi valley. This is where the most fertile soil of Arkansas is located. Nearly half of Arkansas is covered with forests. In the Mississippi plains, there are the hardwood forests, consisting of such trees as elm, oak, and ash, and the softwood forests are in the western area, consisting mainly of simply pine trees. Arkansas is also host to many flowering trees, such as the dogwood and the red haw. The state has a wide range of animal life, with fish such as perch and drum, birds such as geese, ducks, and turkey, reptiles like snakes, lizards, and turtles, and mammals such as deer, bobcats, and minks, all call Arkansas home.

The CLIMATE of Arkansas is moist and mild. There are warm/hot summers and winters are cool. The highland region is slightly cooler. Littler Rock, the capital, has average temperatures of 40 degrees F (4.4 degrees C) and 82 degrees F (27.7 degrees C) in January and July, respectively. The 49 in (124 cm) of annual precipitation comes mostly in the winter and spring. There is a slight difference between the north and the south of the state, where in the north, more specifically the Ouachita Mountains, rainfall averages 54 in (137 cm) a year. In Little Rock the average is 42 in (107 cm) a year. One of the great dangers in Arkansas is TORNADOES; the far north and southwest parts of the state are the most prone to them.

Arkansas was first explored in 1541 by Hernando de Soto for the Spanish, but it wasn't until 1673 that Jacques Marquette traveled the Mississippi to Arkansas and declared it to be French land. John Law, in 1717, attempted to set up the first settlement in the Mississippi valley, but it failed. In 1762, the French ceded the territory over to the Spanish, but then in 1800 reclaimed it, only to sell it three years later to the United States, in the famous LOUISIANA PURCHASE.



Three years after, that the District of Arkansas was created, and after a slow development, more than 30 years later Arkansas was admitted as the 25th state of the Union.

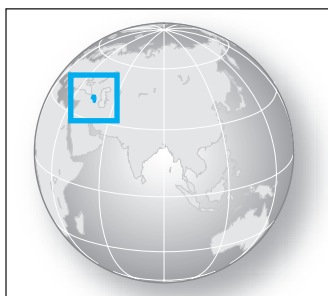
Arkansas is a landmark for civil rights history, as in 1957 and 1958, when the Supreme Court case of *Brown v. Board of Education* was challenged by the governor of Arkansas at the time, Orval Faubus. President Dwight Eisenhower called in troops to ensure that African Americans were integrated into Arkansas public schools.

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## Armenia

**Map Page** 1121 **Area** 11,500 square mi (29,800 square km) **Population** 3,326,448 **Capital** Yerevan **Highest Point** 13,418 ft (4,090 m) **Lowest Point** 1,312 ft (400 m) **GDP per capita** \$3,900 **Primary Natural Resources** hydroelectric potential.



ARMENIA, LYING SOUTH of the towering CAUCASUS range and on the southwestern edge of Asia, is bounded to the north and east by the republics of GEORGIA and AZERBAIJAN, while landlocked to the southeast and west by IRAN and TURKEY.

There is a disputed exclave of Nagorno-Karabakh surrounded by Muslim Azerbaijan. Modern Armenia, a former republic of the Soviet Union, is a small portion of one of the world's oldest centers of civilization, which in the 1st century B.C.E. extended from the BLACK and MEDITERRANEAN seas to the CASPIAN SEA and central Iran. Armenians comprise more than 90 percent of the populations, with the rest being Kurds, Azerbaijanis, Russians, Ukrainians, and others. In 1995, Armenians established a republic, consisting of an elected presi-

dent, an appointed prime minister and cabinet, a 131-member national assembly, and a judiciary branch.

Mountains and elevated volcanic plateaus dominate much of the country, with STEPPE or mountain grasslands in the lower elevations. The land is subject to tectonic activity. On December 7, 1988, a strong earthquake in the northwest destroyed towns and killed about 25,000 people. Only 17 percent of the land is arable and irrigation from its rivers and Lake Sevan is used to help with the aridity of the landscape. Its climate is classified as highland continental, with cold winters and hot dry summers, making autumn the most pleasant season. Rainfall is as much as 32 in (81 cm) on mountain slopes, but it decreases into the plains. Altitudinal zonation of climate determines the variety of crops grown on the Lower Caucasus Mountains.

Under the old Soviet central planning, Armenia developed an industrial focus on machine tools, textiles, and other products, but the machinery is now outdated and privatization is only recently improving industry. More than 15 soil types occur in the country but the hilly, rocky nature of the land along with its aridity inhibits a return to small-scale agriculture. Therefore, Armenia is forced to import foodstuffs. Lamb is the staple meat; fruits, beans, chickpeas, eggplant, yogurt, tabbouleh, and other Middle Eastern dishes make up the rest of the diet.

The Muslim economic blockade of Christian Armenia has cut off most of its oil importation, although the Armenian exclave of Nagorno-Karabakh has vast untapped oil reserves. Hydroelectric power is provided from its rivers and it has been forced to reopen its antiquated nuclear power plant at Metasamor.

Geopolitically, Armenia's conflicted history sheds significant light on cultural development. Once this Indo-European people settled in the region at the beginning of the 6th century, their location on the SILK ROAD and a military corridor drew numerous conquerors and competitors for the land. Medes, Persians, Greeks, Romans, Byzantines, Mongols, Egyptian Mamluks, Ottoman Turks, and Russians all invaded the area. Armenia's conversion to Christianity in 300 ultimately brought them into conflict with Muslim neighbors.

In the early 20th century, emerging Turkish nationalism led to the deportation or killing of 600,000 to 2,000,000 Armenians. Expanding Soviet communism created a small republic, but the Soviet Union's collapse led to a struggle with Muslim Azerbaijan for control of Nagorno-Karabakh. Temporary success produced

a crippling blockade by the surrounding Muslim powers. The new government is trying to lift the land out of its economic and political woes.

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## Aruba

A NETHERLANDS territory in the CARIBBEAN SEA and formerly the A in the ABC Islands, Aruba has come into its own in the past two decades, thanks in large part to aggressive advertisement campaigns on U.S. television. Already prosperous due to oil refineries established by the Dutch in the early 20th century, this advertising strategy aims to make tourism the number-one element in the Aruban economy, long before petroleum resources are used up.

Aruba has an area of 75 square mi (193 square km), and its capital city is Oranjestad. The highest point is Mount Jamanota at 617 ft (188 m) and lowest point is seal level. A population of 70,844 enjoys a gross domestic product per capita of \$28,000.

Aruba lies only 15.5 mi (25 km) off the north coast of VENEZUELA and a few miles west of the other Dutch islands of Curaçao and Bonaire. The islands became a Dutch colony in 1636 but retained a diverse population of local natives, Dutch, Spanish, Portuguese, and English traders, resulting in the curious language combining all of these elements known as Papiamentu. Aruba alone of the Caribbean islands has retained a significant portion of its pre-European population (Arawak), mainly because the islands are too arid to have been developed as commercial tobacco or sugar plantations in the 17th century.

Instead, the ABC Islands became a center of piracy, raiding the rich Spanish galleons as they left the South American ports for Europe and developing as the center of the Caribbean slave trade. Hit hard by the abolition of slavery by the Dutch in 1863, the islands first reinvented themselves as center for the South American

gold rush of the 19th century, then as primary refiners of oil from the Maracaibo oil fields in Venezuela in the early 20th century. The first refinery on Aruba was built in 1920s, at the time the largest of its kind in the world.

Unlike the more tropical islands of the eastern Caribbean, the islands off the coast of South America have a more arid climate, where cacti and aloe vera thrive. The islands are outside the hurricane belt and are sunny and dry (less than 25 in or 64 cm of rain per year), which is a draw for tourists, but also creates the problem of finding freshwater for the large amount of visitors arriving each year, mostly from the UNITED STATES and Venezuela. Large water collection facilities have been set up on Aruba to convert seawater to drinking water, and in the process, this has created a subindustry of salt production. Tourism is an appealing alternative to dependence on Venezuelan oil, which began to diminish after Venezuela opened its own refineries in the 1980s.

Resenting the dominance of its larger neighbor, Curaçao, Aruba seceded from the Netherlands Antilles in 1986 and became a separate, autonomous member of the Kingdom of the Netherlands. Movement toward full political independence was halted at Aruba's request in 1990.

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## Ascension Island

ASCENSION ISLAND IS an overseas territory that forms part of a single territorial grouping (with ST. HELENA and Tristan da Cunha) under the sovereignty of the British crown. Ascension is a small island, 35 square mi (90 square km), of volcanic origin between Africa and South America, just south of the equator. The capital is Georgetown.

Ascension is a rocky peak with 44 distinct craters, all dormant, with its base just west of the mid-Atlantic

ridge. Much of the island is covered by basalt lava flows and cinder cones. The last major volcanic eruption took place about 600 years ago. The highest point (Green Mountain), at some 2,817 ft (858 m), is covered with lush vegetation, which with each rainy season is increasingly spreading throughout the island. The climate on Ascension Island is subtropical, with temperatures at sea level ranging from 68 to 88 degrees F (20 to 31 degrees C) and about 10 degrees F (6 degrees C) less on Green Mountain. Showers occur throughout the year, with slightly heavier rains in the January to April period.

Ascension was discovered by the Portuguese in 1501, claimed by them on Ascension Day, 1503, and settled by the British dating from the 19th century. The island's economic importance (cattle, sheep, fish, turtles, etc.) was always superseded by the military role with its strategic position within the South Atlantic. The British first occupied the island as a strategic geographical base for their global naval interests in the emerging British Empire. Ascension received greater importance as a cable and later wireless station in the late 19th century. During World War II, the Americans used this British island to control naval activities in the South Atlantic. Ascension maintained this strategic military role during the Cold War and also assumed some new functions for the U.S. space program under the National Aeronautics and Space Administration (NASA).

The British renewed their interest in Ascension Island during, and ever since, the Falklands War in 1982. Its position halfway between Britain and the Falkland Islands made Ascension Island the much needed logistic center for the British military operations in the Southern Hemisphere. Most of the inhabitants (about 1,000 people) originate from St. Helena, 750 mi (1,207 km) to the southeast, but there is quite a number of British and U.S. military personnel as well. Ascension was politically dependent on St. Helena but has become more self-governed within the last decades. Fishing will probably remain the most important economic factor of the island, as tourism was always hampered by the remoteness of the territory and the large military presence.

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## Atlantic Ocean

THE NAME OF THE Atlantic Ocean is derived from the Greek god Atlas and means “Sea of Atlas.” Its area is approximately 41 million square mi (106 million square km) including its adjacent seas; volume is approximately 85 million cubic mi (354 million cubic km), including adjacent areas. The average depth of the ocean with adjacent seas is 10,932 ft (3,332 m). The greatest depth is in the North Atlantic at 28,232 ft (8,605 m) in the Milwaukee Deep of the Puerto Rico Trench just north of PUERTO RICO; in the South Atlantic, the greatest depth is 27,651 ft (8,428 m) at the South Sandwich Trench east of the Falkland Islands. The width of the Atlantic varies from 1,769 mi (2,848 km) between Brazil and Liberia to about 3,000 mi (4,830 km) between the United States and northern Africa.

The ocean has a coastline of 69,357 mi (111,866 km). Adjacent areas include the CARIBBEAN SEA, Gulf of Mexico, Gulf of St. Lawrence, Hudson Bay, Baffin Bay, MEDITERRANEAN SEA, BLACK SEA, North Sea, Baltic Sea, Barents Sea, Norwegian-Greenland Sea, and Weddell Sea.

The Atlantic Ocean is the second-largest of the Earth's oceans. Covering approximately 20 percent of globe's surface, the Atlantic is second only to the PACIFIC OCEAN in size. Because the continents bordering its waters in the north are offset to the west of those in the south, the Atlantic appears as an elongated north-south S-shaped channel. In the north, the Atlantic is bounded by North America on the west and Europe on the east, while in the south it is bounded by South America on the west and Africa on the east. It is also linked to the Pacific Ocean by the ARCTIC OCEAN in the north and by the Drake Passage in the south.

The dividing line between the Atlantic and the INDIAN OCEAN to the east has been arbitrarily set at the 20 degrees E meridian, while the dividing line with the Pacific Ocean on the west follows the line of shallowest depth between Cape Horn and the Antarctic Peninsula. In the north, the boundary between the North Atlantic and the Arctic Ocean lies along a system of submarine ridges that extend between Baffin Island, GREENLAND, and Scotland. There is also a boundary between the Atlantic's northern and southern zones, formed by the equatorial counter currents that circulate just north of the equator (8 degrees north latitude) in an area known as the Intertropical Convergence Zone (ITCZ).

The Atlantic Ocean appears to be the youngest of the world's oceans. It began to form during the Jurassic

period, about 150 million years ago, when a rift opened up in the supercontinent of Gondwanaland, resulting in the separation of South America and Africa. The separation continues today at the rate of several centimeters a year along the Mid-Atlantic Ridge, a great submarine mountain range that extends from ICELAND in the north to approximately 60 degrees south latitude, dividing the Atlantic into a series of somewhat equal basins (also known as ABYSSAL PLAINS). Roughly 930 mi (1500 km) wide, the ridge has a more rugged topography than any mountain range on land and ranges from about 0.6 to 2 mi (about 1 to 3 km) above the ocean bottom. The ridge is a continuous feature of the Atlantic floor with one exception, the Romanche Furrow near the equator where the crest of the ridge drops significantly (15,000 ft or 4,573m) below the surface, allowing deep waters to flow freely between the Atlantic's eastern and western basins. Other transverse ridges running between the continents and the Mid-Atlantic Ridge divide the ocean floor into numerous other sub-basins including the Guiana, North American, Cape Verde, and Canaries basins in the North Atlantic and the Angola, Cape, Argentina, and Brazil basins in the South Atlantic. The large Atlantic-Antarctic Basin lies between the southernmost extension of the Mid-Atlantic Ridge and the Antarctic continent.

Although all of its abyssal basins are deeper than 16,400 ft (5,000 m), with many beyond 19,680 ft (6,000 m), the average depth of the Atlantic Ocean is 2 mi (3,300 m), less than the mean depths of both the Pacific and Indian oceans. Unlike the other oceans, the Atlantic has a high percentage (13 percent) of shelf seas (areas where continental crust is covered by water), which is two to three times the percentage found in the other oceans.

The Atlantic has a relatively small number of islands in comparison to the Pacific, with the greatest concentration found in the Caribbean region. Most of the islands are structurally part of the continents. The major islands of the Atlantic include Svalbard, Greenland, Iceland, Great Britain, IRELAND, Fernando de Noronha, the AZORES, the Madeira Islands, the CANARY ISLANDS, the CAPE VERDE Islands, BERMUDA, the West Indies, ASCENSION, ST. HELENA, Tristan da Cunha, the FALKLAND ISLANDS, and the SOUTH GEORGIA Islands. NEWFOUNDLAND is the principal island on the North American shelf, the British Isles the major island group of the Eurafrikan shelf, the Falkland Islands the only major group on the South American shelf, and the South Sandwich Islands on the Antarctic shelf. The is-

lands of Puerto Rico, Hispaniola, JAMAICA, and CUBA (the Antilles) are part of an oceanic arc, while the Madeiras, Canaries, Cape Verde, and the Sao Tome and Principe group are the peaks of submarine ridges. The Azores, Saint Paul's Rocks, Ascension, and the Tristan da Cunha group are peaks of the Mid-Atlantic Ridge system, while the large island of Iceland is a volcanic hotspot at the northern end of the Mid-Atlantic Ridge. Bermuda rises from the floor of the North American Basin, and St. Helena from the Angola Basin.

The Atlantic consists of four major water masses. The North and South Atlantic central waters constitute the surface waters. Sub-Antarctic intermediate waters extend to depths of 3,300 ft (1,000 m), while the North Atlantic deep waters reach depths of as much as 13,200 ft (4,000 m). The Antarctic bottom waters are found at depths greater than 13,200 ft (4,000 m). Waters in the North Atlantic have a clockwise circulation (due to the Coriolis force), while those in the South Atlantic circulate counterclockwise. In addition, the land area that drains into the Atlantic is four times that of either the Pacific or Indian oceans. The major river drainage basins affecting the Atlantic include waters from many of the principal rivers of the world, among them the ST. LAWRENCE, MISSISSIPPI, Orinoco, AMAZON, Paraná, CONGO, NIGER, and LOIRE, and the rivers emptying into the North, Baltic, and MEDITERRANEAN seas.

The circulatory system of the Atlantic's surface waters consists of two large gyres (or circular current systems), with one in the North Atlantic and the other in the South Atlantic. These gyres or current systems tend to be wind driven but are also influenced by the rotation of the Earth. The currents of the North Atlantic (the North Equatorial Current, the Canaries Current, and the GULF STREAM) flow in a clockwise direction from the equator to about 45 degrees north latitude, while those in the South Atlantic (the Brazil, Benguela, and South Equatorial currents) flow counterclockwise from near the equator to about 45 degrees south latitude. As you approach the polar zones, the currents are less completely defined, with one rotating counterclockwise in the Arctic regions of the North Atlantic and another in the South Atlantic rotating clockwise near Antarctica.

Surface salinity values are influenced by evaporation, precipitation, river inflow, and melting of sea ice. The salinity of the surface waters in the open Atlantic range from 33 to 37 parts per thousand, depending on latitude and season. Minimum salinity values are usually found at high latitudes and along coasts of continents where large river flows affect concentration.





Given the volume of water discharged by the Amazon River in northeastern South America, minimum salinity values for the Atlantic are found just north of the equator. The area with the highest salinity values occurs in a part of the Atlantic referred to as the SARGASSO SEA. The Sargasso is somewhat of an ocean desert, with very little rainfall. Given the regions latitude, rates of evapotranspiration (evaporation exceeding rainfall) are quite high leading to the high salinity values in the surface waters.

Surface water temperatures, which are influenced by latitude, current systems, and season, range from 28 degrees F to 84 degrees F (-2 degrees C to 29 degrees C). The most active circulation is found in the uppermost layer of warm water. Below this, circulation becomes increasingly sluggish as the temperature decreases. Surface temperatures range from 32 degrees F (0 degrees C) at the Arctic and Antarctic margins, to 81 degrees F (27 degrees C) at the equator. At depths below about 6,600 ft (2,000 m), temperatures of 36 degrees F (2 degrees C) are prevalent; and in bottom waters, those below 13,200 ft (4,000 m), temperatures of 30 degrees F (-1 degrees C) are common.

The ocean has also contributed significantly to the development and economy of the countries around it. Besides its major transatlantic transportation and communication routes, the Atlantic contains some of the world's most productive fisheries. The most productive of these include the Grand Banks off Newfoundland, the shelf area off Nova Scotia, Georges Bank off Cape Cod, the Bahama Banks, the waters around Iceland, the Irish Sea, the Dogger Bank near the North Sea, and the Falkland Banks. The major species of fish caught in these areas are cod, haddock, hake, herring, and mackerel.

There are also abundant petroleum deposits in the sedimentary rocks of the continental shelves. Large amounts of petroleum are currently being extracted in the North Sea and in the Caribbean Sea and Gulf of Mexico region, with lesser amounts coming from the Gulf of Guinea near the African coast. Actively mined mineral resources include titanium, zircon, and monazite (phosphates of the cerium metals), off the eastern coast of Florida, and tin and iron ore, off the equatorial coast of Africa.

## PORTS AND HARBORS

The Atlantic is currently served by a large number of ports and harbors, including major ports or harbors in Alexandria (EGYPT), Algiers (ALGERIA), Antwerp (BELGIUM), Barcelona (SPAIN), Buenos Aires (ARGENTINA),

Casablanca (MOROCCO), Colon (PANAMA), Copenhagen (DENMARK), Cork (Ireland), Dakar (SENEGAL), Gdansk (POLAND), Hamburg (GERMANY), Halifax, Nova Scotia (CANADA), Helsinki (FINLAND), Las Palmas (Canary Islands, Spain), Le Havre (FRANCE), Lisbon (PORTUGAL), Liverpool (UNITED KINGDOM [UK]), London (UK), Marseille (France), Montevideo (URUGUAY), Montreal (Canada), Naples (ITALY), New Orleans (UNITED STATES), New York (United States), Newport News (United States) Oran (Algeria), Oslo (NORWAY), Peiraeus (GREECE), Rio de Janeiro (BRAZIL), Rotterdam (NETHERLANDS), Saint Petersburg (RUSSIA), Southampton (UK), and Stockholm (SWEDEN). While these ports play active roles in the economies of the countries bordering the Atlantic, the PANAMA and Suez canals (as links to the Pacific and Indian oceans) greatly enhanced that value by shortening the distance to markets on the Pacific Rim or within the Indian Ocean.

The Atlantic is currently faced with a number of important environmental issues, including endangered marine species (manatees, seals, sea lions, turtles, and whales); drift net fishing; municipal sludge pollution from the eastern United States, southern Brazil, and eastern Argentina; oil pollution in the Caribbean Sea, Gulf of Mexico, Lake Maracaibo, Mediterranean Sea, and North Sea; and industrial waste and municipal sewage pollution in the Baltic Sea, North Sea, and Mediterranean Sea.

Natural hazards include icebergs, which are common in the Davis Strait, Denmark Strait, and the northwestern Atlantic Ocean, particularly between February and August. Occasionally, they have been spotted as far south as Bermuda and the Madeira Islands. Ships traveling in the extreme northern Atlantic from October to May are subject to heavy icing on their superstructure, and persistent fog can be a major hazard anytime between May and September. Hurricanes also pose a significant threat to the land areas along the Atlantic coast and tend to be most common between May and December.

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## Atlas Mountains

THE ATLAS MOUNTAINS of northwest Africa are an elaborate assemblage of mountain ranges that trend from southern coastal MOROCCO and the CANARY ISLANDS, through ALGERIA into coastal TUNISIA. Extending more than 1,500 km (932 mi) and chiefly composed of sedimentary and igneous rocks that have been folded and faulted over the past 85 to 150 million years, the Atlas peaks are a part of the Tethyan Mountain network, an immense mountain group that extends roughly 6,700 mi (11,000 km) and includes the ALPS and Carpathians of Europe, and the CAUCASUS, ZAGROS, Pamir, and the HIMALAYAN mountains of Asia. Furthermore, earthquakes occur regularly along this complex chain, indicating that mountain-building is still taking place.

In Morocco, the Atlas Mountains (“Idrren Dnren” in Berber) consist of four chains: the High, Middle, Anti, and Rif ranges separated by fertile and productive plains. Although the Rif Mountains are traditionally considered not a part of the Atlas system, their uplift epoch, or orogeny, and general trend indicate that they are related. Likewise, although the Middle (Moyen) Atlas are considered a separate range, topographically they are a lower extension of the High (Haute) Atlas complex, where the great Jebel Toubkal rises tallest in the chain at 13,665 ft (4,165 m).

As the mountains bend into Algeria’s arid backcountry, the steep peaks flatten into distinctive plateaus. Here, the range has two particular spines: the northern, coastal Tell (or Maritime) Atlas chain and the southern, inland Saharan Atlas Mountains. As they head to the northeast, these ranges encircle the Chott Plateau before consolidating into a single range that follows the coast across Algeria into northern Tunisia.

The Atlas chain also plays an important role in modifying the climate throughout the region. Dividing the mild Atlantic and Mediterranean coasts from the SAHARA DESERT’s harsh environment, western and northern slopes receive greater amounts of rain and snow, sustaining numerous farms and orchards along

the headwaters of Morocco’s and Algeria’s ephemeral rivers and wadis (dry riverbeds except in the rainy season). The slopes to the east and south, however, commonly support xeric vegetation like grasses and shrubs and common arid land features like salt pans and dry lake beds influenced from the rains shadow of the mountains.

The Atlas Mountains are also rich in minerals and oil. Phosphate, and metal ores including lead, zinc, copper, silver, manganese are productive commodities, while important coal deposits and petroleum reserves are managed in Morocco, Algeria, and Tunisia. Into the 2000s, as tourism and recreation programs develop throughout the region, the Atlas Mountains are attracting thousands of travelers during the winter each year to ski and trek in the snow, and in the warmer months, tourists can backpack, tour, and hike all across the vast area. The highest peaks of the Atlas Mountains include Jebel Toubkal in the High Atlas Range; Jebel Siroua in the Anti-Atlas Range, 10,843 ft (3,305 m); Jebel Tidiquin in the Rif Mountains, 7,835 ft (2,448 m); Jebel Chelia in Saharan (Aures) Atlas, 7,638 ft (2,328 m).

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## aurora borealis

NORTHERN LIGHTS, or the aurora borealis, are shimmering lights that shine above the Earth near the geomagnetic North Pole. The lights, often bright enough to read by, are usually green or red. The phenomenon is caused when a solar storm discharges high-energy particles that are channeled into a ring by the Earth’s magnetic field. The solar particles energize atoms in the thin ionosphere, which cause emissions of light.

The solar particles travel from the sun in a field called, at different stages, a plasma or solar wind. Because the solar wind and the magnetic field of the



Earth are constantly interacting, the northern lights may appear as an arc, a curtain, or an undulating sheet. When the electrons from the sun excite oxygen atoms, those atoms glow green. If they get extremely excited, red is the color produced. Blue and violet lights result from interaction with nitrogen radicals, a pink glow comes from neutral nitrogen, and excited hydrogen shows as blue and green. Each color glows at a particular altitude as well. Thus, the auroras can actually serve as a map of the composition of the ionosphere.

The aurora borealis usually glows from 50 to 100 mi (80 to 160 km) above the ground, but it can occur at lower altitudes and, on rare occasions, at ground level. Astronauts, the only persons who get to see the lights from above, have flown through auroras and report that even with eyes closed, they see flashes of light from the charged particles as those particles pass through their eyeballs.

The solar particles that react with Earth's atmosphere to form the lights circle the geomagnetic poles, so the aurora borealis is usually seen in places above a latitude of 30 degrees. The land areas that see most displays of northern lights include northern ALASKA, the Hudson Bay region, ICELAND, and northern Scandinavia. Clear nights in these areas are dark enough to view the lights from September to April. Since the lights are brightest following solar storms, several websites provide updated forecasts of such activity. Following earlier research, scientists in 1957 and 1958—the International Geophysical Year—mapped an oval band, about 310 mi (500 km) wide, that circles Earth's magnetic poles. Within this band, about 1,250 mi (2,000 km) from the pole, the aurora borealis can be seen on almost every dark night.

Areas as far south as the New England portion of the UNITED STATES may see an aurora borealis several times during the year, but sightings farther south are rare. Very large solar storms have resulted in lights being seen far south of the usual viewing range, but this happens only once per decade, on average. An aurora in 1859 was observed as far south as Honolulu, HAWAII.

Observations of the northern lights date back to the time of Aristotle, who described an aurora around 349 B.C.E. A Viking record titled Kongespeilet (King's Mirror), written circa 1250 C.E. states that the light blazes like a living flame. Poems by Samuel Taylor Coleridge, Robert Browning, and Sir Walter Scott, among others, have mentioned the aurora borealis; in the 1600s, philosopher René Descartes suggested that sun-

light scattered from ice particles in the upper atmosphere was the cause of the northern lights.

## MAGNETISM

Astronomer Edmund Halley proposed in the early 18th century that the lights were caused by Earth's magnetism. One hundred years later, in 1825, C. Hansteen indicated a link between the lights and geomagnetism. In 1860, Elias Loomis, an American, mapped out the distribution of northern lights geographically and showed that they formed a ring around the North Pole. In his 1881 work *Das Polarlicht*, Swiss physicist and engineer Herman Fritz extended Loomis's research. Both men identified a correlation between the auroras and sun spots, noting that the lights grew stronger and weaker following the 11-year cycle of sunspot activity. In 1896, Norwegian physicist Kristian Birkeland showed with models that electrons from the sun would bend toward the Earth's magnetic poles and enter the ionosphere, where they decelerated and emitted light. Current research shows that the electrons thrown by the sun generate currents as great as a million amperes. This was also proposed by Birkeland, but in 1896 the idea was ignored.

A similar phenomenon occurs around the southern geomagnetic pole and is called the aurora australis.

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## Australia

**Map Page** 1126 **Area** 2,967,895 square mi (7,686,850 square km) **Population** 19,731,984 (2003) **Capital** Canberra **Highest Point** 7,311 ft (2,229 m) **Lowest Point** 49 ft (15 m) **GDP per capita** \$27,000 **Primary Natural Resources** gold, silver, uranium.





THE COMMONWEALTH of Australia is the world's sixth-largest country and is located on the world's smallest continent between the INDIAN OCEAN and the South PACIFIC OCEAN. The countries surrounding Australia are NEW ZEALAND to the southeast, PAPUA NEW GUINEA to the northeast, and INDONESIA and EAST TIMOR to the north. Australia is a democratic federation under the Commonwealth of Nations, which recognizes the British monarch as the head of state, who is represented through the governor-general. Australia is divided into six states and two territories, including the island of Tasmania. The legislature is a bicameral federal parliament that provides popular and state representation. The prime minister serves as the head of government.

Australia is roughly the size of the continental UNITED STATES. Due to millions of years of erosion, its coastline is generally even, with few indentations. Constant wind and water erosion give Australia the distinction of being the flattest continent. Australia's interior consists of the Great Western Plateau, the Central Lowlands, and the Eastern Highlands. Much of the Great Western Plateau is desert, particularly, the Great Sandy Desert, Gibson Desert, and Great Victoria Desert, where much of Australia's mineral wealth is located. The Central Lowlands contains the Great Artesian Basin, which holds 670,000 square mi (1,735,300 square km) of underground water. The Great Artesian Basin serves as pasture land for Australia's traditional sheep ranching industry. The major cities of Australia are located in the Eastern Highlands, along the eastern and southeastern coast, which consists of plateaus, hills, and low mountains.

Australia's climate, while it varies greatly, does not suffer extreme temperatures because it lacks physical barriers. Beyond its northern coast is the GREAT BARRIER REEF, one of the great natural wonders of the world, which is in danger from pollution. The climate is generally arid to semiarid. In the north, the climate is tropical, while temperate in the south and east. The tropical region has a hot and rainy season from February to March and a warm dry season. The deserts in central and western Australia receive only 10 in or 25.4 cm of rain. Because of Australia's position in the Southern Hemisphere, the seasons occur opposite to those experienced in the Northern Hemisphere. In the south, January and February are the hottest months, with temperatures averaging between 65 and 70 degrees F (18.3 and 21.1 degrees C). June and July are the coldest months, with temperatures averaging 50 degrees F or 10 degrees C.

The first humans who settled in Australia came over from a land bridge that once connected Australia to Asia. The Aborigines, who are the descendants of those first settlers, are a hunter-gatherer society that roamed about the land. They spoke about 250 languages and all of their property was communal. Before the arrival of Europeans, Aborigines numbered between 250,000 and 1 million.

The first European to sight Australia was Captain James Cook in 1770. He circumnavigated the Australian coast and landed in Botany Bay, claiming the land for Britain. After the loss of the thirteen North American colonies, the British government saw Australia as a new destination to which it could send convicts. In 1787, the First Fleet, under the command of Captain Phillip Arthur, set sail from Portsmouth, England, to Australia, consisting of 11 ships carrying 1,487 people, of whom 736 were convicts whose crimes were mostly petty theft. In January 1788, the First Fleet landed on what became Sydney Harbor. The penal settlements of New South Wales, Van Diemen's Land (later Tasmania), and Port Phillip District (later Victoria) were established, while Western Australia and Southern Australia were created as free settlements.

In 1851, gold was discovered in Victoria, sparking an influx of immigrants from all over the world. The population grew from 450,000 in 1850 to 1 million in 1858. The effects of the gold rush were the growth of national wealth, a spirit of egalitarianism, and the spark of nationalism.

By the end of the nineteenth century, Australia evolved from penal settlements to self-governing units where settlers took part in local affairs. In the 1890s, Australia was at a crossroads in its relationship to the mother country. Some circles called for independence from Britain, while others called for self-government within the BRITISH EMPIRE. Economic forces such as a worldwide depression and increasing unionization called for uniform laws and regulations.

On January 1, 1901, the Commonwealth of Australia was born, which fused British and American models. The Commonwealth would be a parliamentary government like Britain, but it would have a federal system like the United States, where there would be state and popular representation in its legislature. Not long after, Australia gained the distinction of having a progressive government by establishing a minimum wage, ensuring safe conditions for workers, and granting suffrage for women. Yet at the same time, the new government maintained the "White Australia"

policy which limited immigration to Europeans and mostly British.

Australia maintained its loyalty to Britain by contributing troops to the Boer War, World War I, and World War II. Australian troops distinguished themselves bravely during the famous Gallipoli campaign of World War I. However, after the end of the war, the troops who came home had difficulty readjusting to civilian life, partly because of well-meaning but, in the end, inadequate government policies. Australia suffered greatly during the Great Depression of the 1930s, when as much as 28 percent of the workforce was unemployed.

By World War II, Australia's traditional links to Britain and the empire began to weaken. In 1939, Australia sent troops to Europe to fight Nazi GERMANY. However, JAPAN loomed as a larger threat to Australia's security. Australia fell under the protection of the UNITED STATES. After the war, Australia entered into the ANZUS alliance with New Zealand and the United States and began looking to Asia as a source for new markets. In 1972, the "White Australia" policy was replaced with an immigration policy that stressed multiculturalism and accepted immigrants from other areas of the world. In 1999, Australians once again faced the terms of their relationship with Britain, voting whether to keep the queen as head of state or declare itself a republic; a slim majority maintained the status quo. In 2002, after the terrorist bombings at Bali, Australia joined the United States as one of its coalition partners in the war against terrorism, providing troops to Iraq in 2003.

Despite the official end of "White Australia," the population remains generally homogeneous, with 92 percent of European origin, 7 percent of Asian origin, and 1 percent of Aboriginal origin. However, since the end of World War II, Australia has accepted immigrants from eastern and southern Europe, adding to the old English stock. Australia's relationships with the Aborigines have not been easy. European colonialism had wiped out much of the original population through disease and assimilation. While Australians have become more sensitive to the plight of the Aborigines, many have remained at the bottom of the economic ladder.

Australia has a prosperous free market economy that is ranked with western European economies. Services make up 71 percent of the gross domestic product (GDP), while industry makes up 26 percent, and agriculture makes up 3 percent. In 2000, Sydney hosted the Olympic Games, 44 years after its rival, Melbourne.

The Australian economy suffered during the global economic slowdown in 2001, but it has been undergoing a recovery since 2003. In 2004, the Australian government debated whether to approve a free trade agreement with the United States.

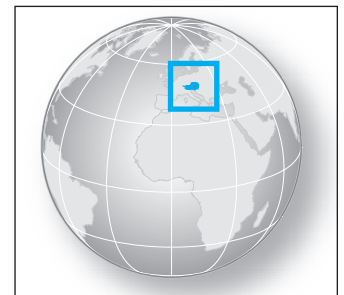
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## Austria

**Map Page** 1131 **Area** 32,377 square mi (83,858 square km) **Population** 8,188,287 (2003) **Capital** Vienna **Highest Point** 12,457 ft (3,797 m) **Lowest Point** 377 ft (115 m) **GDP per capita** \$25,400 **Primary Natural Resources** natural gas, iron, timber.



**LANDLOCKED AUSTRIA** (Österreich in German) is located at the cultural and geographical crossroads of Central Europe. It is also situated in between the three major cultural spheres of Europe. To the south is ITALY, to the north GERMANY, and to the east several Slavic countries. This relatively small country (about the same size as MAINE) borders no less than eight other countries. Austria itself is overwhelmingly German-speaking and Roman Catholic (although, as is most of Europe, relatively secular in orientation).

Today's Austria was created as what can be described as a historical accident. Before countries, or nation-states, existed in the modern sense, local rulers controlled small territories that sometimes grew to large empires. Seated in Austria, the Habsburg dynasty became one of the most powerful in Europe as early as the medieval era and governed a territory that included parts of today's FRANCE, Italy and Germany. Over time,

the Habsburg empire lost control over some of these western territories and instead expanded eastward, and after 1867 it became the Austro-Hungarian Empire, two separate states under one common ruler. The name Austria then simply referred to the predominantly German-speaking territories, which previously were not considered a coherent territorial unit. The eventual demise of Austria-Hungary was triggered by its involvement in the Balkans. Several European powers struggled for influence in southeastern Europe, which subsequently led to World War I. Austria-Hungary was on the losing side in the war, and along with a rewriting of the political map of large portions of Europe, modern Austria, now a republic, was born in 1918.

What emerged as the state of Austria was several small regions that had some basic cultural attributes in common—language and religion—but nevertheless lacked a distinct national identity. Part of this has to do with Austria's fragmented geography. The most dominant landform is the ALPS—the mountains that cover the entire western portion of the country and stretch deep into central Austria. Like many populations that inhabit mountainous areas, the Alpine dwellers have historically been localist in their orientation rather than identifying with a larger nation. The remaining parts of Austria are lowland and river valleys, more populous, and dominated by the capital of Vienna. As Austria has been a state for almost a century, national media, a national educational system, and other nationwide institutions have created a greater sense of common identity over time.

Vienna is a classic example of a primate city—a city that dominates in a country in terms of size and political, economic, and cultural importance. Vienna has approximately 1.5 million inhabitants, while the second- and third-largest cities, Graz and Linz, have populations of only approximately 200,000 each. In the 18th and 19th centuries, Vienna was one of the most important cities in Europe, even a world city. As the capital of a large multi-ethnic empire, the city became a diverse political and economic power thriving on immigration from both German and non-German regions. This diversity also made Vienna an intellectual and creative center in many divergent endeavors, such as philosophy, arts, and economics.

The power of Vienna during this time period is also reflected in its impressive environment, with its beautiful baroque and other architectural styles, which attracts many visitors. Vienna is located on the DANUBE (Donau in German) that flows from Central Europe eastward to the BLACK SEA, a convenient location his-



*St. Stephen's Cathedral in Vienna is one reason why the capital is also Austria's primate or dominant city.*

torically, as well as centrally located within Austria-Hungary. Today, Vienna's eastern location near the Slovak border is peripheral within Austria. Facing the Iron Curtain, it was also far away from the population centers of western Europe during the Cold War and lost population. In the future, however, Vienna and Austria hope to capitalize on its proximity to the growing markets of eastern Europe.

Austria was economically prosperous during the post-World War II period, much like the rest of western Europe. Today, the economy is increasingly service-oriented, including the largest tourist economy per capita in Europe. There is, for example, one guest bed for



every six Austrians. Both summer and winter tourism is common in the Alps, with the latter growing in importance. Visitors arrive from many countries, but Germany has always been the leading source of tourists. The tourism industry is also one reason behind the long-standing trend of population growth in western Austria at the expense of eastern Austria. The Alpine landscape is not only utilized by foreign visitors, but skiing has become the nation's favorite recreational activity and has produced outstanding national sport heroes, most recently Hermann Maier.

Tourism has changed rural life, but it has also made it possible for part-time farmers to survive. The Austrian government (and now the EUROPEAN UNION, which Austria joined in 1995) also extends economic support to farmers to preserve a traditional, small-scale agricultural landscape. On the negative side, avalanches are one of the otherwise few natural risks in Austria, many lethal to skiers and others, killing dozens every year. Economically, Austria's tourism economy is also facing challenges as European tourists are searching for more exotic and far-flung experiences than the Alps.

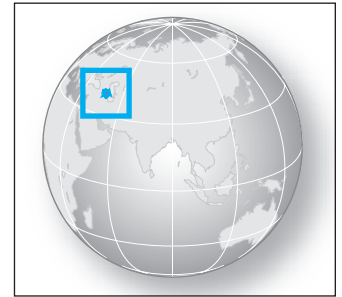
Recent trends are changing the social and economic fabric of the country. Global competition is felt in all sectors of the economy. Generous social benefits of the welfare state are increasingly difficult to maintain as the population is aging (while life expectancy is very high, the fertility rate of 1.3 children per woman is one of the lowest in western Europe). Immigration increased in the 1990s, particularly from eastern Europe and former Yugoslavia, leading to a rise in xenophobia and a new right-wing, anti-immigrant political party that upset the traditional consensus and cooperative spirit of Austrian politics. Austria is again struggling with its national identity, its past as part of Nazi Germany, and an increasingly multiethnic society that will shape the country for decades to come.

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## Azerbaijan

**Map Page** 1121 **Area** 53,820 square mi (86,600 square km) **Population** 7,830,764 **Capital** Baku **Highest Point** 15,551 ft (4,740 m) **Lowest Point** Caspian Sea -92 ft (-28 m) **GDP per capita** \$3,400 **Primary Natural Resources** petroleum, natural gas.



AZERBAIJAN, A FORMER Soviet republic, now officially the Republic of Azerbaijan, is a nation with a Turkic and majority Muslim population. It regained independence after the collapse of the Soviet Union in 1991. It is located in the region of the SOUTHERN CAUCASUS MOUNTAINS, and borders the CASPIAN SEA to the east, GEORGIA and RUSSIA to the north, IRAN to the south, and ARMENIA to the southwest and west. A landlocked nation, Azerbaijan has three dominant physical features: the Caspian Sea, whose shoreline forms a natural boundary to the east; the Greater Caucasus Mountain range to the north; and the extensive flatlands at the country's center. Of the three Transcaucasian states (Georgia, Armenia, and Azerbaijan), Azerbaijan has the greatest land area. A small part of Nakhichevan also borders TURKEY to the northwest. The capital is the ancient city of Baku, which has the largest and best harbor on the Caspian Sea and has long been the center of the republic's oil industry.

The country's elevation changes over a relatively short distance from lowlands to highlands; nearly half the country is considered mountainous. Notable physical features are the gently undulating hills of the subtropical southeastern coast, which are covered with tea plantations, orange groves, and lemon groves; numerous mud volcanoes and mineral springs in the ravines of Kobustan Mountain near Baku; and coastal terrain that lies as much as 92 ft (28 m) below sea level. Except for its eastern Caspian shoreline and some areas bordering Georgia and Iran, Azerbaijan is ringed by mountains. To the northeast, bordering Russia's Dagestan Autonomous Republic, is the Greater Caucasus range; to the west, bordering Armenia, is the Lesser Caucasus range.

To the extreme southeast, the Talysh Mountains form part of the border with Iran. The highest elevations occur in the Greater Caucasus, where Mount Bazar-dyuzi rises 15,551 ft (4,740 m) above sea level. Eight large rivers flow down from the Caucasus ranges



into the central Kura-Aras lowlands, alluvial flatlands, and low DELTA areas along the seacoast, designated by the Azerbaijani name for the Mtkvari River and its main tributary, the Aras. The Mtkvari, the longest river in the Caucasus region, forms the delta and drains into the Caspian a short distance downstream from the confluence with the Aras.

Partly because of the great range of altitude in the country, there is a variety of climate, vegetation, and soil conditions. Climate varies from subtropical and dry in central and eastern Azerbaijan to subtropical and humid in the southeast, temperate along the shores of the Caspian Sea, and cold at the higher mountain elevations. Because most of Azerbaijan receives scant rainfall—on average 5.9 to 10 in (15.2 to 25.4 cm) annually—agricultural areas require irrigation.

Azerbaijan shares all the formidable problems of the former Soviet republics in making the transition from a command to a market economy, but its considerable energy resources brighten its long-term prospects. A continuing conflict with Armenia over the Nagorno-Karabakh region may be an obstacle to economic growth.

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## Azores

THE AZORES IS AN archipelago of nine islands situated in the middle of the North ATLANTIC OCEAN, usually divided in three groups according to geographic proximity: the Eastern Group (Santa Maria and São Miguel), the Central Group (Terceira, Graciosa, São Jorge, Pico, and Faial), and the Western Group (Flores and Corvo). The Azores constitutes, along with Madeira, the only two autonomous regions of PORTUGAL, each with its own parliament and government.

These lush green islands (897 square mi or 2,322 square km, with a population of 241,763) are the peaks of an oceanic mountain chain, and their volcanic

origin is associated with the clash of the American, European, and African tectonic plates. The area is subject to frequent EARTHQUAKES and has current manifestations of volcanic activity with geysers and sulfur springs. The latest eruption occurred in 1957–58 on the island of Faial. On several of these islands, volcanic cones have collapsed originating rings of landforms called caldeiras.

### PORTUGUESE SETTLEMENT

It is assumed Diego de Silves was the first to explore these uninhabited islands in 1427. Their combination of fertile soil, abundant water, and mild climate contributed to a successful settlement by the Portuguese in 1443. Most of the land is hilly and covered by cropland, pastures, and forests of introduced cryptomeria conifers and acacia trees and native cedars and dogwood. Because of the proximity of the GULF STREAM, the climate is humid and temperate, with an abundance of rain throughout the year. However, weather can vary widely during the course of a single day.

Until recently, the regional economy depended on an export-oriented agriculture, subjecting the islands to alternating cycles of prosperity and decline according to external demand for their products. Main commodities have included oranges and sugarcane, with corn replacing wheat as the main cash crop at the end of the 19th century. Cattle grazing became the main agricultural activity around the 1960s, as the humid climate favors development of rich pastures. Current regional products include milk, cheese, corn, with tobacco and pineapples on the island of São Miguel and wine on Pico.

The average area of farms is very small (4 acres or 2 hectares), with fields divided by hedges of hydrangeas or azaleas, forming a typical patchwork, which has become a hallmark of the islands. Most of the population concentrates on small coastal towns. The seat of the government ministries and largest city is Ponta Delgada (population 44,000), on the island of São Miguel.

The Azores's islands have benefited from strategic importance since the 16th century, through the age of discoveries to modern times. Because of its central position between North America and Europe, the archipelago has played important role as a resupply outpost during the development of both navigation and aviation. Nevertheless, the isolation led to intense emigration to the UNITED STATES and CANADA and a consequent population decline between the 1960s and 1990s. That tendency has recently reversed thanks to rising living

standards and development, made possible in part by support programs from the EUROPEAN UNION.

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## Bab el Mandeb

CONNECTING THE RED SEA with the Gulf of Aden and the ARABIAN SEA, bounded by DJIBOUTI, ERITREA, and YEMEN, the Bab el Mandeb is a STRAIT and CHOKE POINT. It separates the Arabian Peninsula from East Africa (HORN OF AFRICA). As its Arabic name implies (“Gate of Tears”), it is a place of worry for any ship’s captain navigating the narrow passage. It has historically been coveted by anyone wishing to control the flow of trade between the MEDITERRANEAN SEA and the INDIAN OCEAN. Egyptian barges, Arab dhows, and Portuguese caravels have all plied this narrowing passage. Each controlling nation has fought others that attempted to wrest it from them.

Britain vied for dominance of the area with both the OTTOMAN EMPIRE and FRANCE. The British seized Aden in 1839 and the Ottomans returned to the northern portions of Yemen in 1849. France focused on the African coast and established the colony of French Somaliland in 1888. With the construction of the Suez Canal in 1869, the increase of shipping made the Bab el Mandeb all the more important. The French remained in Djibouti, while the British departed Yemen and the port of Aden in 1967. Yemen remains an unstable area. In the decade of the 1990s, a full-scale civil war exploded, and internal factions and international terrorist groups launched attacks against government

and commercial targets. The attack on a French-flagged oil tanker by a small boat filled with explosives in October 2002 in the Bab el Mandeb points to continuing concerns.

The Bab el Mandeb is one of the world’s busiest shipping lanes, handling the vast majority of all ocean-going trade between Europe and Asia. An estimated 3.2 million barrels of oil passed through this strait every day in 2000. The Bab el Mandeb is about 17 mi (27 km) wide at its narrowest point between the Arabian and African coasts. The island of Perim sits astride the strait, creating two channels. The eastern channel is known as the Bab Iskender (Gate or Strait of Alexander), which speaks to the ancient lineage of navigation in these waters. This channel is some 2 mi (3 km) wide and about 98 ft (30 m) deep. The western channel has a width of about 16 mi (25 km) and a depth of 1,017 ft (310 m). There are a group of small islands lying just off the African coast.

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## Bahamas

**Map Page** 1137 **Area** (land) 1,509 square mi (3,870 square km) **Population** 297,477 **Capital** Nassau **Highest Point** 208 ft (63 m) **Lowest Point** 0 m **GDP per capita** \$17,000 **Primary Natural Resources** timber, salt, aragonite.



THE ISLAND OF San Salvador is cited as the first landing spot in the New World by the explorer Christopher Columbus on October 12, 1492. The small, low-lying chain of islands and cays were then passed over by the Spanish in favor of larger islands and silver and gold on the mainland. Today, however, the independent nation of the Bahamas boasts one of the most prosperous economies and most stable governments in the region, thanks to tourism and its close location to the continental UNITED STATES.

Lying just 90 mi (140 km) off the coast of FLORIDA, the chain includes over 700 islands—only 30 of which are inhabited—plus 2,000 cays. Stretching from northwest to southeast across 600 mi (968 km), the islands have a total of 2,196 mi (3,542 km) of coastline and form a total land area roughly equivalent to JAMAICA. The islands are mostly long, flat coral formations with some low rounded hills.

The main island, New Providence, with the capital city of Nassau, is at the northern end of the chain, between the largest islands in the group, Andros, Eleuthera, Grand Bahama, and Great Abaco. Other main islands include Cat Island, Great Exuma, and Long Island in the center of the chain, and Great Inagua at the southern end. Great Inagua is roughly 62 mi (100 km) from CUBA and 50 mi (81 km) from HAITI. The TURKS AND CAICOS ISLANDS geologically form a southern extension of the Bahamian archipelago but have mostly been administered separately and remain dependencies of the UNITED KINGDOM. The islands of New Providence and Grand Bahama have roughly four-fifths of the population. Most Bahamians live in towns (84 percent, one of the region's highest), either in Nassau or in the other major towns, Freeport (on Grand Bahama) and Matthew Town (on Inagua).

The islands' original inhabitants, the Lucayans (Arawaks), were completely removed to work plantations on Hispaniola and Cuba. Poor soil and few freshwater resources meant that the Bahamas were not

developed as tobacco or sugar plantations like other Caribbean islands, so the islands remained sparsely populated. Settled by British pirates and traders from 1647 onward, the islands became a haven for the most notorious criminals of the Caribbean, notably Blackbeard. The English government tacitly supported raids against Spanish galleons heavily laden with gold bullion. After the abolition of slavery in British colonies in the 1830s, the Bahamas remained a point of slave smuggling and was also home to blockade runners during the U.S. Civil War. This sort of activity became prominent again in a different form in the 1920s and 1930s, when the Bahamas became a chief smuggling center for alcohol into the United States during Prohibition. The economy was again stimulated by the arrival of gambling after the casinos were closed in Havana during the Cuban Revolution (1959).

The Bahamas led the British West Indies in their move to independence, becoming independent in 1973, yet retaining full ties to the Commonwealth and the British crown. Since independence, the government has focused on expanding its industries, primarily in the spheres of tourism and related services, taking full advantage of the country's pleasant, sunny climate, and proximity to the United States. An estimated 3 million tourists visit the islands each year, representing roughly 13 percent of all tourist spending in the Caribbean.

Small local manufacturing industries, including cement, salt, rum, and pharmaceuticals, along with oil refining and transshipment, provide many jobs, but the largest growth area is in development as an offshore financial center, drawing in over 150 major banks from North America and Europe through its specially structured tax and trust laws. Banking and e-commerce are now among the top revenue generators for the government, along with ship registrations (the fifth largest in the world). But the islands continue to maintain their reputation as a haven for illegal activity, becoming once again a center for smuggling into the United States, this time marijuana and cocaine from South America.

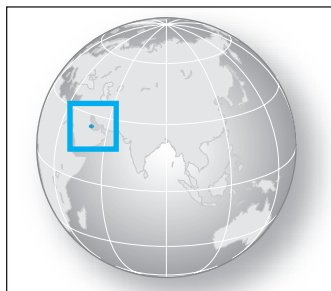
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## Bahrain

**Map Page** 1122 **Area** 256 square mi (665 square km) **Population** 667,238 **Capital** Manama **Highest Point** 400 ft (122 m) **Lowest Point** 0 m **GDP per capita** \$15,100 (2002) **Primary Natural Resources** oil, natural gas, fish, pearls.



BAHRAIN IS LOCATED in the MIDDLE EAST; it is an archipelago in the PERSIAN GULF, east of SAUDI ARABIA. Bahrain has been the site of human habitation and commerce for millennia. Evidence of active trade between the great hearths of human civilization in Mesopotamia and the Indus Valley are to be found on the islands of Bahrain from as early as 5,000 years ago. Assyrian, Babylonian, Greek, and Persian kings laid claim to this trading center over the ages.

First mentioned in Greek historical sources associated with Alexander the Great, Bahrain continued under its Greek name Tylos until the spread of Islam reached its inhabitants in the 7th century. Regional and foreign powers ranging from the Ummayyad caliphs of SYRIA to the Christian monarchs of PORTUGAL continued to claim and dominate this pearling and trade center until the 18th century. In 1783, the Al Khalifa family seized Bahrain from a Persian garrison controlling the islands and established a ruling dynasty that continues to today.

In the 1830s, the ruling Al Khalifa family entered into treaties with Britain as a protectorate and maintained that status until full independence was declared on August 15, 1971. Bahrain benefited as the first Gulf state to discover and exploit its oil potential beginning in the 1930s, but it never experienced vast oil wealth. Limitations on actual oil reserves within its national borders encouraged Bahrain to develop a more diversified economy that focused on petroleum refining rather than extraction.

Following independence from Britain, the Al Khalifa monarchy experimented with election of a parliament but soon dissolved the National Assembly because of antagonism toward the monarchy and Western allies. The ruling family, the majority of government officials, and corporate leaders are Sunni Muslims. Bahrain's Shia majority (70 percent) was politically disaffected and incidents of political violence were seen in the 1990s, resulting in killings and impris-

onment. With the latest succession within the ruling family, a return to national elections has commenced, along with a general political amnesty. This first national election in over three decades saw a turnout of over 53 percent of eligible voters in the first round and 43 percent in the second round. The latest ruling Al Khalifa has changed his title from emir to king and continues to appoint the upper chamber of parliament as a balance to the lower generally elected chamber.

Bahrain has been the home of U.S. naval operations in the Persian Gulf since 1947 and has provided basing and overflight rights in support of military actions against Iraq since 1990. Bahrain supported the decade of sanctions conducted by coalition forces in support of United Nations mandates against Iraq.

Bahrain's economic diversification provided the Gulf region with an early window to Western financial, telecommunications, and industrial expertise. The region's first oil refinery was built here in 1935 and heralded continual growth of joint ventures that expanded to ship building, metal manufacture, transportation infrastructure, and financial services. Bahrain boasts the presence of many international finance institutions and has created no impediments to their onshore or offshore operations. Bahrain further seeks to become the largest center of Islamic banking in the world. Working toward this goal, it has become a leader in the standardization of regulation for the Islamic banking industry.

Bahrain was quick to invest oil revenues into national infrastructure, health services, and education. Bahrain enjoys the highest adult literacy rate in the region (89.1 percent). The modern communications and transportation network combined with Bahrain's reputation as a relatively liberal and modern Persian Gulf state has added to its desirability as a tourist destination. With its special emphasis on education, Bahrain sees itself as a future provider of higher education in the region. Much financial support and investment has come from gulf neighbors. Saudi Arabia continues to subsidize much of required government revenue by granting oil as aid.

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## Baikal, Lake

THE BAIKAL, the world's deepest lake, stretches 391 mi (636 km) long and nearly 50 mi (80 km) wide. On the northeastern borders of central Asia, it lies at an altitude of 1,494 ft (455.6 m) above the PACIFIC OCEAN sea level. With an area of 12,162 square mi (31,500 square km), the Baikal ranks seventh in the world after the CASPIAN and ARAL seas, the North American HURON, MICHIGAN, and SUPERIOR lakes and VICTORIA in Africa.

The lake is surrounded by the vast mountains of the Eastern Sayan massif with an absolute altitude of 11,453 ft (3,491 m). Many of the Sayan mountain rivers flow into the Baikal, like the Irkut and other tributaries of the Angara. The Baikal region is characterized by a continental climate. In winter, the mean temperature falls to 1 to -13 degrees F (-17 to -25 degrees C), the absolute minimum is -35 to -40 degrees F (-37 to -40 degrees C). The mean summer temperature of July, normally the warmest month in the Baikal region, is 66 to 68 degrees F (19 to 20 degrees C), with a maximum of 100 degrees F (38 degrees C).

The underwater slopes of the Baikal depression show a distinct ancient relief of the coastline. Down to depths of 1,640 to 1,968 ft (500 to 600 m), it uncovers submerged mouths of rivers and ancient valleys. About 3.5 million years ago, the Baikal was born by a rift when the Eurasian and Indian plates collided. Tectonically, the lake consists of three deep basins, each separated by underwater uplifts. Winds and changes in the atmospheric pressure have an influence on the water level. The mean perennial level stands normally at 1,494 ft (455 m). The highest level, measured on October 2, 1869, was 1,499 ft (457 m); the lowest, 1,492 ft (455 m), was observed in April 1904.

The first research on the Baikal was done in the 18th century by the German explorers I.E. Gmelin, P.S. Pallas, and I.G. Georgi. Systematical studies on the Baikal were encouraged in the 19th century by the Russian Geographical Society. W. Dybowsky distinguished in 1912 two complexes of the Baikalian fauna: the general Siberian fauna and the endemic fauna. In response to the ecological conditions, these two species are developing completely differently. Ordinary Siberian fauna do only colonize the areas of mild temperatures, that is, near the shores. In contrast, indigenous Baikalian fauna can be found in the depth of the lake. Therefore, the temperature of the water presents an ecological barrier. The greatest enigma for scientists is the presence of seals in Baikal. Alexander VON HUMBOLDT suggested in 1843 that the presence of seals in

the Caspian Sea and the Baikal was evidence of a past connection between these two lakes.

The German explorer O. Peschel believed in 1878 that Baikal was directly connected with the Arctic Ocean and that seals migrated from the north. Others, like V.P. Garyayev (1901) and German paleontologist M. Neimeier (1886), thought that the fauna of Baikal was a relict of an old marine fauna. The Baikal environment is very sensitive to ecological changes. When in 1957 the Soviet government planned to build a cellulose plant at Baikal'sk, local scientists, citizens, and writers like Valentin Rasputin launched a protest campaign that succeed after thirty years. In April 1987, the Soviet government issued a decree protecting Lake Baikal. Nevertheless, the cellulose plant is still producing industrial waste and dumping it into the lake.

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## Baikonur

BAIKONUR IS THE former Soviet Union's primary space launch facility. In the early days of the Soviet space program, rockets were launched from Kasputin Yar, a small field in the lower VOLGA RIVER basin not far from Stalingrad (modern Volgograd). However, this launch facility had numerous problems. Mists rising from the Volga River frequently delayed or altogether prevented scheduled launches. The flight path went over several settled areas, raising significant safety concerns if a rocket were to fail catastrophically in atmosphere. Worse, launches could be monitored by an American base in nearby TURKEY, an unacceptable situation to a government for whom security was considered essential.

As a result, the Soviet government decided to create a new, larger base in a remote, secure area that would still be accessible by rail and water links to the industrial centers of the western Soviet Union. Construction began in June 1955 near the village of Tyuratam in the Kazakh Soviet Socialist Republic (one of the 15 constituent republics of the Soviet Union), not far from the ARAL SEA. The Soviet government acknowledged the

launch facility's existence in 1961, but in the secrecy of the time, called it the Baikonur Cosmodrome, after the railroad town of Baikonur nearly 239 mi (385 km) away. Western journalists were not permitted to visit the 600-square-mi (1,554-square-km) facility until 1989, under Soviet leader Mikhail Gorbachev's program of glasnost or openness.

### COSMONAUT'S WALK

The base complex started as a cluster of low, white buildings and concrete blockhouses on the sandy desert, an environment more reminiscent of the American White Sands test range of NEW MEXICO or the rocket test stands of Edwards Air Force Base in CALIFORNIA than the oceanfront vistas of Kennedy Space center at Cape Canaveral, FLORIDA. The equipment in the underground control center was reminiscent of those used on Mercury launches; bare-bones oscillographs, radar scopes, and the like with little in the way of advanced computer technology. The original Baikonur launchpad included an enormous four-part service structure that surrounded the rocket. Interestingly enough, the elevator stopped somewhat short of the top, so that technicians and cosmonauts going to the capsule had to climb a set of steps known as the "cosmonaut's walk."

The technicians and scientists working at Baikonur lived in nearby Zvyezdograd (Star City). This medium-sized town was a purpose-built settlement of the sort the Soviets often created near a major project to house its workers. Zvyezdograd is often lumped together with the cosmodrome proper as Baikonur.

The original Sputnik satellite was launched from Baikonur, as were many other important satellites and all the Soviet Union's manned launches. The Buran space shuttle was also launched from here in its single remote-controlled flight and was brought to land on the cosmodrome's landing strip. (It has subsequently been taken to Moscow and turned into an amusement-park ride.)

In a long-standing launch tradition, all Soviet and post-Soviet Russian rockets are always rolled out of their assembly building at 7 A.M. local time, commemorating the hour the Vostok rocket was rolled out for Yuri Gagarin's historic flight on April 12, 1961, in which he became the first human being to fly in space. Unlike U.S. rockets at Kennedy, Russian rockets are transported horizontally on a special rail car and are cranked upright at the pad.

Following the 1991 dissolution of the Soviet Union, Baikonur belonged to the newly independent

republic of KAZAKHSTAN. Nursultan Nazarbayev, the new president of Kazakhstan, founded the Kazakh Institute of Space Research to coordinate with Russia in operating the Baikonur Cosmodrome. Russian economic problems have led to serious deterioration of the facilities, and most of the personnel are aging, as no younger scientists and technicians have been hired. However, following the February 1, 2003, crash of the U.S. space shuttle Columbia and the grounding of the remainder of the shuttle fleet, the Russians bore the full burden of launches to keep the International Space Station manned and operating, in spite of severe economic difficulties.

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## Balkhash, Lake

LOCATED IN eastern KAZAKHSTAN, Lake Balkhash is the world's sixteenth-largest lake, covering a surface area of about 7,000 square mi (18,000 square km); however, its size is being reduced by overutilization of streams that flow into the lake. Closed, with no outflow, Lake Balkhash, like the ARAL SEA at the opposite end of Kazakhstan, has suffered from misuse of water resources. Both have been slowly shrinking for years in area, depth, and volume. Now, in independent Kazakhstan, the lake has fared little better than it did in Soviet times.

Within a complex mountainous drainage basin, Lake Balkhash is fed mainly by the Ili River, as well as by the Karatal and Aqsu rivers. While these streams have long been used for a variety of needs in this arid and seasonally cold watershed, in recent decades developments have caused reductions of stream flow into Lake Balkhash. One major withdrawal has been the filling of the Kapchagay (Qapshaghay) Reservoir on the Ili River. More broadly, the growing population in western CHINA has placed additional demands on the

headwaters of the Ili River. The mountainous location of the source of the Ili River in western China instead of in eastern Kazakhstan has significantly complicated any potential resolution of environmental woes of Lake Balkhash. This negative externality requiring international negotiations over water flows includes about 15 percent of the watershed for Lake Balkhash.

With these and other concerns about water supply, officials at the United Nations Development Program have issued warnings that the lake could dry up to an extent similar to that of the Aral Sea. Kazakh statistics indicate that a surface area reduction occurred by 2003.

### AGRICULTURAL PRODUCTION

On the Kazakh side of the border, water from the lake and its tributaries long has been withdrawn for municipal, agricultural, and industrial uses. Irrigation in Kazakhstan continues to be prominent in this rural region. Ironically, agricultural production has fallen significantly since the 1990s, but water usage remains at the same levels because of artificially set nominal prices for water.

A major example of industrial use has been the copper mining, smelting, and refining industries in and near the city of Balkhash, along the northern shores of the lake. The third-largest copper producer of the Soviet Union, the city, through its smelting plants, annually emits some 80,000 tons of particulate matter. This effluent, in addition to the natural sediments carried in the river inflows, has caused considerable sedimentation of the lake, which now is separated into eastern and western parts, divided by a sandbar. The western portion of the lake is slightly larger by surface area (58 percent), but shallower (only 46 percent of volume).

While Lake Balkhash generally is considered a saline lake, though mildly so, the eastern portion of the lake has increased in salinity more than the western side. With greater freshwater inputs to the west and with limited exchange of water between sides, the eastern waters have progressively differed more and more from the western portion. Environmental damage to the lake's waters also has reduced fish catch, so that amelioration of the problem was sought by introduction of exotic fish species from other parts of the former Soviet Union. This tactic has had mixed results, with some exotic species dominating native species.

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## Baluchistan

BALUCHISTAN, A SOUTHWESTERN province of PAKISTAN, extends from the Gomal River in the north-east to the ARABIAN SEA in the south and from the borders of IRAN and AFGHANISTAN in the west and northwest to the Sulaiman Mountains and Kirthar hills in the east. In its continuity to the west lies Iranian Baluchistan. The land of Baluchistan is exceedingly inhospitable; geologists have even compared the landscape with Mars.

Baluchistan can be divided into two distinct regions. To the northeast, hedged in between Afghanistan and the Indus plains, stretch long ridges of rough highlands. The average breadth of this highland lobe is 150 mi (241 km), but in the north it narrows to less than 100 mi (161 km) along the Gomal River. This area is bounded by the Sulaiman range on the east and the Toba-Kakar range in the northwest. The main central range of Sulaiman, decreasing in height from north to south, forms the dominant geographical feature of the northeast Baluchistan. This region is mainly inhabited by an ethnic group, the Pathans.

The highlands of Sarawan and Jhalawan in Kalat is a block of territory measuring about 300 mi (483 km) by 300 mi (483 km), which is primarily the home of the Brahui and the Balochi, but with a great variety of physical conditions and inhabitants. The Hab River between the Pab and the Kirthar ranges, the Purali or Porali, draining the low-lying flats of Las Bela, the Hingol, and the Dusht in Makaran are all considerable streams, draining into the Arabian Sea and forming important arteries in the network of internal communications. Between southwestern Baluchistan and the northeastern lobe is the wedge-shaped Kachhi plain, which is a land of dust storms and violent winds. Here temperature does not fall below 100 degrees F (38 degree C) in summer and drops below the freezing point in winter.

The mountain ranges of Baluchistan are formed of Cretaceous and Tertiary beds, forming part of an extensive system of Tertiary (Alpine-Himalayan) times.



Besides the Cretaceous and Tertiary beds, Jurassic rocks occupy considerable areas of Baluchistan. With the exception of the Upper Cretaceous and lower Tertiary, especially in northwestern Baluchistan, there is an extensive development of volcanic tuffs and conglomerates probably contemporary with the Deccan traps of India. The sharp bends of the hill ranges around the Kachhi plain have contributed to the instability of this area and have made it seismically important; Quetta was subjected to violent EARTHQUAKES in 1931 and 1935.

Excluding the coastal strip in the south, Baluchistan has a subtropical continental climate marked by extremes of temperatures and aridity. Kachhi and the Chagai-Kharan areas are two of the hottest and driest regions of the subcontinent.

The annual rainfall on the whole is less than 8 in (20 cm), increasing to about 15 in (38 cm) at Shahring in the northeast and falling in the northwest to less than 3 in (7.6 cm). Most of the rain occurs in winter as a result of western disturbances. Summer rains from the monsoons are important only in the northeast. The coast has moderate temperatures and low rainfall and is dominated by a steady inflow of sea breeze in summer.

The region is scant in vegetation and most of the hills are bare of forest growth. On the plains and lower highlands, trees and herbs are conspicuously absent, and the bare stony soil supports a jungle of stunted scrub, the individual plants of which are almost all armed with spines, hooks, and prickles of diverse appearance. In the upper highlands, the vegetation is extremely varied according to local conditions.

Nothing is known about the area until the time of Alexander the Great, whose armies crossed Las Bela and Makaran from east to west in 325 B.C.E. Later, the area probably passed under the control of Parthians and later to the Kushan dynasty. About this time, Buddhism flourished in Baluchistan. In 707 C.E., Mohammed bin Kasim captured various strongholds in Makaran, advanced into Sindh, and established the Muslim power in the Indus valley.

From 1595 to 1638, the province formed part of the Mughal Empire. The Balochi, who gave their name to the province, are comparatively recent arrivals. They apparently entered Baluchistan in the 11th and 12th centuries, being driven out of Persia by the Seljuks. Their rivals, the Brahuis, who occupy the highlands of Sarawan and Jhalawan in Kalat, are of Dravidian stock. The British control ended in 1947 and Baluchistan became the part of independent Pakistan.

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## Bangladesh

**Map Page** 1123 **Area** 55,126 square mi (133,910 square km) **Population** 138,448,210 (2003) **Capital** Dhaka **Highest Point** 4,035 ft (1,230 m) **Lowest Point** 0 m **GDP per capita** \$350 **Primary Natural Resources** natural gas, arable land, coal.



BANGLADESH HAS been an independent country since 1971, when it seceded from PAKISTAN in South Asia. Prior to Muslim occupation (1203), its people were believers of Hinduism and Buddhism. With British colonization since 1757, Western influence included a British educational system and the introduction of English, which even today remains the language of the elites. The BAY OF BENGAL lies to the south, INDIA is to the east, west, and north. It has a limited boundary with MYANMAR (Burma). Ninety-eight percent of Bangladeshis speak Bengali (Bangla), the national language; 83 percent are Muslims and 16 percent Hindus.

Three major rivers of the country are the GANGES, Brahmaputra, and Meghna. They discharge an enormous amount of water to the Bay of Bengal, only surpassed by the AMAZON and CONGO rivers. The southern part of the country consists of a DELTA formed by the confluence of the Ganges and Brahmaputra rivers. North-central and southeastern parts are mountainous.

Most of the country is low-lying and riverine and susceptible to flooding during the rainy season, which starts in June and lasts until the beginning of October. Its tropical monsoon climate is erratic; some years cause heavy rainfall; some are normal or have occasional draughts. Its annual rainfall averages 60–80 in

(152–203 cm). Floods and occasional droughts ravage the country, bringing about misery. Cyclones (hurricanes) originating from the Bay of Bengal just before and after the rainy season, cause heavy damage in the southern part.

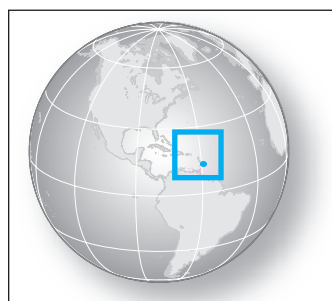
Because of high rural population density, land is intensively cultivated. As one of the most densely populated countries of the world, Bangladesh suffers from severe overpopulation: 80 percent of country's labor force is employed in agriculture. Rice is the principal food crop; rural Bangladeshis often eat three meals of rice every day. A third of Bangladeshis live below the poverty line. Dhaka, with an estimated population of about 12 million, is the capital and pacesetter of the country. Since its independence and the assassination of the founder of Bangladesh, Sheikh Mujibur Rahman (father of the nation), in 1975, the country has alternated democracy with military dictatorships.

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## Barbados

**Map Page** 1137 **Area** 168 square mi (431 square km)  
**Population** 277,264 **Capital** Bridgetown **Highest Point** Mount Hillaby 1,109 ft (336 m) **Lowest Point** 0 m  
**GDP per capita** \$14,500 **Primary Natural Resources** petroleum, fish, natural gas.



BARBADOS IS ONE of the clearest success stories of the CARIBBEAN SEA, with one of the most prosperous economies and stable governments in the region. Having one of the highest population densities in the world (1,548 per square mi), Barbadians were also one of the first nations (in 1955, second only to INDIA) to implement a family planning program, which has resulted in one of the lowest birthrates in the Western Hemisphere. Much of the current population growth is due to the return of Barbadians who emigrated to the

UNITED KINGDOM (UK) in the 1950s and are now retiring back home. For most people in 18th-century Britain, Barbados was the Caribbean—British settlers had been on the island since 1627; its main town, Bridgetown, was a large, bustling trade city, and the colony had become the largest and wealthiest of all the English colonies, surpassing VIRGINIA and MASSACHUSETTS. The colony had over 40,000 English residents, and one of the oldest legislatures in the New World.

Lying about 100 mi (161 km) east of the main arc of the Antilles, the island was usually the first port of call for Europeans crossing the ATLANTIC OCEAN. The Portuguese had first named the island “bearded ones,” after the bearded fig trees they found there. There were no original inhabitants at first encounter, so there was no resistance to overcome for the great number of planters who came to set up small farms for tobacco, cotton, and indigo.

The land is relatively flat, with a gentle rise to a central highland. As part of the eastern arc of the Antilles (including Antigua, St. Martin, and ANGUILLA), any volcanic activity is much more distantly removed, and the older, more weathered soil, is very rich and commercially viable on a large scale, especially in the central highlands. The “sugar revolution” of the 1640s to 1680s thus began here and ultimately changed the overall economy of most of the region. As small farms were replaced with large plantations, most English landowners were squeezed out by the sugar barons and resettled in the Guianas and SOUTH CAROLINA, replaced by large numbers of slave laborers imported from Africa. Barbados was the center of the sugar-producing world until the abolition of slavery in 1834, but the industry continued to dominate, run both by freed Africans (the majority of the population), and some descendants of white laborers (called “Red Legs”).

Barbados was one of the first British colonies to achieve independence, in 1966, with one of the easiest transitions to self-rule. It remains an active member of the Commonwealth, with the British monarch continuing to serve as chief executive. Production and export of sugar have declined in the past 30 years, but locally produced rum remains a specialty. Agriculture has become more diverse, producing more vegetables and fruits for domestic consumption, but much of its food is still imported. More than 80 percent of the population is employed in service industries, mostly tourism. Tourists generally come from the UK, not from the UNITED STATES, so Barbados retains its British style in many ways more than its Caribbean neighbors (the closest being St. Vincent and the Grenadines). There is

a growing U.S. presence in the data processing industry, taking advantage of the very literate Barbadian population (99 percent).

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## Barcelona

BARCELONA IS THE second-largest city in SPAIN after MADRID and is the capital of the autonomous region of Catalunya/Cataluña (Catalonia), which is situated in the northeast of Spain. The region is bordered to the north by the PYRENEES mountain range, which acts as a natural border between Spain, ANDORRA, and FRANCE; to the east the region is bordered by the MEDITERRANEAN SEA; to the west by the region of Aragon; and to the south by the Valencia region.

The metropolitan area of Barcelona has a population of approximately 3 million citizens, although only about 1.6 million of this total reside within the bounds of the city proper. The city comprises a number of distinct districts, each with its own character and urban form, which includes Cuitat Vella, the old city area, the 19th-century Eixample/Ensanche (extension), Montjuïc, Sarrià, Gràcia, and new districts (Nou Barris) such as Trinitat Nova at the city periphery. As a consequence of these different districts, it is possible to walk by Roman remains, medieval buildings, and modern developments within a short space of time, particularly if walking westward from the low-lying seafront areas such as Barceloneta or Barri Gòtic (Gothic district) to the hills surrounding the city.

Like many other settlements in Spain and Europe, Barcelona has a long history, and the Romans were significant to its early development. Today, the outline of the Roman Forum can still be seen in the center of the city, and parts of the city walls built by the Romans also remain. During its history the city has been controlled and fought over by a number of different peoples, including the Visigoths in the 5th century, the Frankish Kings of the 9th century, and the Muslim statesman Al-Mansur in 985. The golden age of

Barcelona as an economic and cultural power, however, dates from the late 19th century, although its development was late when compared with other European cities in England and France.

Nonetheless, upon the tearing down of the medieval city walls in the mid-19th century, the city for the first time was able to develop at a rate never seen before in its history. But this removal of the city walls was in part necessary because of the cramped, disease-ridden conditions of the old city and the fact that the lack of space also hindered its growing industrial base. Therefore, with the removal of the city walls, Barcelona was able to spatially, economically, and culturally expand itself, and this legacy comprises vast sways of the city's urban form today.

For example, the huge district known as Eixample, laid down to a plan by Ildefons Cerdà (1815–76), not only transformed the old settlement but remains a major element of the modern city today. Characterized by its geometrically formed grid crossed by wide avenues, the Eixample was a pioneering urban project within which considerations were made for traffic circulation, sunlight, and ventilation in the houses built within square-shaped blocks (the corners of which are rounded).

Within this large district are found many of the city's most beautiful buildings as well, including numerous edifices by renowned architect Antonio Gaudí who designed largely in Gothic inspired and an art nouveau style. Among the most prominent of Gaudí's works in the Eixample are the Casa Batlló, Casa Milà (La Pedrera, the "quarry"), and La Sagrada Família (The Holy Family, from 1884), probably the city's most famous symbol after its football team, Barcelona Football Club. Gaudí's legacy in the city today forms an integral part of the city's tourist industry, and tourists from all over the world come to the city to marvel at his work and also the city's rich culture, which includes museums of the modern artist Joan Miró and the father of cubism, Pablo Picasso.

In recent times, Barcelona has become synonymous with international sporting and cultural events, such as the 1992 Summer Olympics and the 2004 International Forum of Cultures, and many people see these events as integral elements in the development of the city and its economy. In reality, Barcelona has a tradition of hosting famous events that dates from 1888, when it held the Universal Exposition; this tradition was continued into the 1920s with the World's Fair, an event in which Ludwig Mies van der Rohe helped develop modernist architecture through the design of his

Pavilion building. Nonetheless, these events have helped architecturally, economically, and culturally shape the city and its urban form, the result of which is a vibrant, cosmopolitan center today that inspires both eye and mind.

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## basaltic flows

THE WORD *basalt* is said to have an Ethiopian origin, meaning “black stone.” Basalt is a dark gray to black, dense to finely grained igneous rock that is the result of lava eruptions. Basalts are not only the most abundant lavas, but they are also the most voluminous. Basalt, when exposed to the air, becomes covered with a brown crust, consisting largely of oxides of iron. The continental masses are mainly built up of granite material, but at some places they are injected with or penetrated by material of greater density from the layers below. These lower layers may be the source of the great basaltic extrusions on the Earth’s surface. Basalt flows are noneruptive, voluminous, and characterized by relatively low viscosity. They generally advance less than one mile or kilometer per hour on gentle slopes and may reach more than 30 mi (50 km) from their source or erupting vent.

A lava flow is defined as the product of a single eruption that may be divisible into one or more flow units, which represents a single pulse or surge of lava that flowed away from the eruptive vent and then cooled separately. The length of the lava flow is determined largely by the magma effusion rate. Basalt lava flows that originate from fissures spread for distances that are roughly proportional to the third power of their thickness.

These lava flows are called flood basalts because a large volume of lava erupted in a short period of time. Each flood of lava has its own unique chemical composition. The dark area that forms part of the moon’s face is a flood basalt eruption. Flood basalt regions exist on every continent. In plains basalt provinces such as Snake River and ICELAND flows are much less than 1

cubic mi or km. Basaltic lava flows in HAWAII extend for more than 21 mi (35 km) with an average thickness of 16 ft (5 m). Andesite flows have higher viscosity and few extend more than 9 mi (15 km). One andesite flow of Pleistocene age in the Cascade range is 50 mi (80 km) long. One Icelandic basaltic flow reached 93 mi (150 km).

## FISSURE ERUPTIONS

In the past, fissure eruptions have taken place on a gigantic scale. The basaltic lava of the Deccan Trap in INDIA, and the lava flows of the Snake River Plains in the UNITED STATES, appears to have been poured out from fissures. The basalt flows of the northeast of IRELAND and in Skye, Mull, and other islands of the Hebrides are of a similar type, and are merely the remains of an enormous lava field that probably extended as far as GREENLAND. The flows apparently came from fissures. In western OREGON and western IDAHO, the lava spilled out of giant fissures in the Earth’s crust that stretched for more than a 100 mi or km during a period from 15 to 17 million years ago covering an area of 20,000 square mi (52,000 square km). Hundreds of such flows were erupted in this region. The basalt oozed in large quantities from fissures. Some examples include the following.

The Deccan Trap, an extensive area in western and central India, has been covered with basaltic lavas. The horizontality of the lavas has resulted in the formation of flat-topped plateaus at different elevations with either steep walls or terraces on the lower flows. These have a steplike arrangement. In the area east of the Western Ghats, the scenery is like that of a country of mesa and buttes.

The Giant’s Causeway, a World Heritage Site in Ireland, is an area of 40,000 tightly packed basalt columns resulting from a volcanic eruption 60 million years ago. Vertical joints form hexagonal columns and give the impression of having been artificially constructed. The columns were formed as a natural consequence of lava cooling. The tallest are about 40 ft (13 m) high. The tops of the columns form stepping stones that lead from the cliff foot and then disappear in the sea.

Columbia River basalt, where the flood basalt flows beneath the Columbia basin, accumulated to a thickness of more than 5,000 ft (1,724 m). Their many layers are clearly visible along the paths of the Snake. The Columbia River plateau was created by a series of basalt flows. It covers more than 62,000 square mi (164,000 square km) of area of the Pacific Northwest.



Over 17 million years ago cracks in the Earth's surface began spewing molten basaltic lava and the basalt floods continued in one form or other, until about 6 million years ago. Much of this lava spread to cover large parts of Oregon and WASHINGTON. Columbia River basalt consists of 270 individual lava flows within an average volume of 135 cubic mi (561 cubic km) per flow. Out of them, 21 poured through the Columbia River gorge. The uniqueness and beauty of the Columbia River gorge is attributed to basalt flows. As the flows flooded the region's lowest areas, they filled canyons and permanently altered the river's path on several occasions. Basalt flows exposed in the walls of the gorge feature a jointing arrangement. These arrangements were created as the lava flow solidified.

On the Snake River plain, the lava flows of the Snake River are complex, in terms both of structure and emplacement processes. Basalt flows consist of long tortuous bodies with many side lobes. Most flows accumulate as small, low shields, fissure flows, or large tube-fed flows.

Flood basalt flows from even earlier times and their impact on the Earth's environment are now being looked at as a possible cause for the extinction of the dinosaurs and other forms of life. The eruption of the Deccan flood basalts in India, ten times larger than the Columbia River basalt, occurred at the time the dinosaurs died out 60 million years ago. These tremendous lava eruptions could dramatically alter the climate, giving rise to the conditions that could have caused mass extinction, common through the history of the Earth.

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## bases of trade

**GEOGRAPHIC BASES** of trade are places established for the trade or exchange of commodities and/or the transshipment or warehousing of goods. While a base of trade may develop into a multifunctional adminis-

trative and/or ceremonial center, its original function as a nodal point at the intersection of at least two discreet networks remains the center's primary reason for existence, until that intersection ceases to be of importance for the trading partners.

Scholars of premodern trade (to the early 1800s in industrialized countries) have identified several categories of trading bases, most prominently **ENTREPOTS** or emporia, fairs, solar central places, ports of trade, and gateway communities. While these categories often denote similar sites, they were created by different disciplines to describe the role of the trading base in different disciplinary contexts.

*Entrepots/emporia* and *fairs* are terms used in historical sources and, therefore, by historians. Entrepots/emporia were permanent trading bases, located either in a town's harbor, but physically separated from the town, or as a free-standing colonial trading settlement situated at the border between two distinct ethnocultural zones. Both types were permanent bases administered by port officials to collect tariffs and maintain a peaceful and fair trading zone through special laws for foreign merchants. Although entrepots could operate on a seasonal basis, their primary purpose was trade.

Fairs, in contrast, were generally of short duration, were held at multifunctional centers, and could move cyclically among several such centers over the course of a year. There were three types of fairs, serving local, regional, and interregional trade. Local fairs lasted one to two days, had a small catchment area (30-mi or 48-km radius), transacted a low volume of goods (cattle and salt), and saw small-scale traders selling directly to the locals. Regional fairs could last up to two weeks, had a larger catchment area (up to a 200-mi or 321-km radius), had a higher turnover of goods, and saw merchants buying or selling to specialized producers. Interregional fairs had durations of three to eight weeks, a large catchment area (up to a 600-mi or 965-km radius), and specialized in the sale of luxury items that were carried directly to the fair over long distances. The Champagne fairs of FRANCE are the best-known example of a circulating fair, which began as local fairs, grew into regional fairs for Flemish cloth agents, and eventually became Europe's largest fair circuit for the exchange of cloth and other goods for spices and luxuries brought by Italian merchants from the East.

Economic geographers and anthropologists use other categories to explain premodern exchange systems. The solar central place is used by geographers to describe a site that serves as the center of an interlock-

ing system of lower hierarchical centers. Administered by elites, the central place maximized the exchange of goods by shortening the distance between more distantly dispersed centers in the region.

While central place theory stresses spatial relationships, the anthropological model of the port of trade, developed by Karl Polanyi, places focus on institutional factors. Ports of trade bordered two distinct economic, environmental or ethnocultural zones and operated as “neutrality devices” to facilitate trade between foreign merchants and the host population. Like the entrepot/emporium, a port of trade was founded by a tacit or explicit agreement between foreign traders and the local elites. In order to sustain peaceful trade, however, the long-distance trade occurring at the segregated port of trade could not interfere with the local trade of the hinterland, a criterion that is often impossible to demonstrate with archaeological evidence.

In contrast, the geographical gateway community is a more flexible type, describing a trading base that bordered different mineral, agricultural, and/or craft production zones, was situated on a trade route, and satisfied a demand for trade goods. Administered trade via formal agreements and special foreign merchant laws is not a requirement. Like the port of trade, however, the gateway community was also a monopolistic market, the goods of which were used by elites to maintain their status, whereas the solar central place was but one, albeit the senior, place in a system of points in a multinodal regional exchange system.

Several themes emerge from these models. Bases of trade were not common in the interior of homogenous environmental and economic zones. Peasants in large agricultural zones tended to produce all that was required for a subsistence lifestyle, and therefore had little need for trading bases. Small luxury items were obtained from itinerant merchants. Concomitant with the rise of states, tax- and rent-paying peasants were compelled to sell agricultural goods and livestock at local fairs, held periodically at a nearby center.

By way of contrast, peoples living in marginal environments, such as deserts, arid grasslands, or along coasts that lacked an agricultural hinterland, pursued less diversified forms of subsistence, which necessitated that they trade with neighboring peoples in different economic environmental zones for goods that they could not produce themselves. Central Asian and Saharan desert nomads, for example, brought animal products from their flocks to entrepots/emporia or ports of trade located on the desert’s edge to trade for grain, metals, and fibers produced by local agriculturalists. In

order to maximize their trade at the Savannah entrepots, such as Timbuktu, the Berber nomads of the western Sahara became intermediaries between the Maghreb and sub-Saharan Africa, transporting salt from desert oases to the savannah, where salt was scarce, returning north with gold and ivory. Like pastoral nomads, “aquatic peoples” such as the Bobangi fishermen of the middle CONGO RIVER practiced a limited form of subsistence that needed to be supplemented, trading their surplus fish at points along the river for the yams and manioc of neighboring agriculturalists.

Another aquatic culture, the Greeks, whose terrain was arid, rocky, and better suited to viticulture, established emporia or ports trading colonies on the coasts of the more productive agricultural territories north of the Black Sea, where they exchanged their wine and olive oil for grain. As the more mobile and dependent trading partners, the Berbers, Bobangi, and Greeks brought their goods to agriculturalist markets, becoming middlemen as well for exchange between more distant markets.

## DEEP HARBORS

Changes in transport technology and the emergence of rival networks influenced the location of trading bases as well. As the volume of trade increased in northeastern medieval Europe, entrepots/emporia with shallow harbors were bypassed for deep-harbored trading settlements that could accommodate heavier cargo vessels. Advances in ship-building technology and the greater use of Mediterranean sea routes cut the cost of luxury trade with the East, causing the decline of the Champagne fairs, which depended on expensive overland routes. When ships became the dominant medium for commercial transport from the 15th to the 18th centuries, coastal sites were the main centers for inter-regional trade, such as Hormuz (PERSIAN GULF) and Gao (western INDIA) for the INDIAN OCEAN trade. The importance of overland bases returned in the 19th century, however, as new fairs and entrepots/emporia were established along railroad lines, such as Irkutsk and Vladivostok, which functioned as waystations for the Trans-Siberian Railroad. Attracting permanent populations from western Russia, the Trans-Siberian trading bases quickly evolved into administrative and political centers.

With the modern global economy based on brokerage and credit, bases of trade are now increasingly less determined by geographic location. While port and airline facilities are still important, the presence of bank-

ing and stock market facilities, such as those in NEW YORK CITY, LONDON, and TOKYO, are of prime importance for sustaining an interregional center.

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## basin

BASINS ARE LARGE-SCALE depressions in the land surface or seafloor. Their sides may dip gently or steeply, but their bottoms are always wider than they are deep. Streams flowing into basins often fill their floors with sediments. Lakes typically occupy lower parts of the basins on land, thus they may fully emerge as lakes dry up. The largest water-filled basins are ocean basins—the PACIFIC, ATLANTIC, and INDIAN ocean basins. Basins exist because of land erosion or structural geology.

Three agents of erosion are prolific creators of basins on land—rivers, glaciers, and groundwater. Rivers form large drainage basins by eroding mountainous areas through tentacle-like systems of incising tributaries. The MISSISSIPPI-Missouri River and the Ohio River basins are examples of this basin type. Glaciers create basins by plucking (quarrying) huge chunks of rock as they move over underlying bedrock. They reveal the basins after they melt back during warm periods. The size of glacier basins varies considerably. The now extinct Laurentide ice sheet created the Hudson Bay Basin in northern CANADA.

In the continent's midsection, the same glacier quarried the Great Lakes basins and the smaller but impressive Finger Lakes basins in upstate NEW YORK. Former alpine glaciers scoured even smaller basins—cirque and rock basins that are scattered throughout the ROCKY MOUNTAINS, HIMALAYAS, ALPS, and other high Alpine regions. Groundwater (or water underground) also creates basins. The cool water is acidic and dissolves limestone to create a Swiss-cheese network of

underground solution channels and subsurface caves. Over time, a cave roof collapse creates increasingly larger basins, which geomorphologists call dolines and uvalas. These solution basins are typical of KARST regions (areas whose landforms develop by solution in limestone).

Oceanic, intermontane, fault block and synclinal basins are results of rocks that subside, warp, fold, or break. The shape, size, and topography of oceanic basins are results of all these movements. Ocean basins have many structural sub-basins that collect thick, undisturbed layers of fine-grained deposits. On land, the largest basin is the intermontane basin, a broad area enclosed by higher landforms. The Great Basin region, which sits between the Pacific Mountain System and the Rockies in the western UNITED STATES, is a good example.

A third basin type—the synclinal basin—is composed of downfolded layers of sedimentary rocks. The LONDON or PARIS basins are examples. Synclinal basins can be important, as they fill with sediment and thereby help preserve any layers of coal beneath, such as in the Saar Basin in FRANCE, the Donets Basin in UKRAINE, or the Wyoming Valley in PENNSYLVANIA. The smallest basin is the fault block basin (graben), which is typical of basin-and-range terrain. Vertical displacement along the faults (normal faulting) creates the basin. The Great Basin region has numerous fault block basins and intervening ranges.

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## Bay of Bengal

THE BAY OF BENGAL is a triangle-shaped water body, which is an extension of the INDIAN OCEAN to the north. It is stretched over an area of 5.7 million square mi (14.7 million square km) with an average depth of approximately 8,530 ft (2,600 m). Countries that surround the bay are SRI LANKA, INDIA, BANGLADESH,

MYANMAR (Burma), THAILAND, and MALAYSIA. West Bengal and Bangladesh are located at the extreme northern end of the Bay of Bengal, and gave the bay its name. The cyclones (hurricanes) originating in the Bay of Bengal, usually before or after the rainy season, devastate the southern part of Bangladesh regularly, and occasionally they affect the West Bengal state of India and Myanmar. The bay has a significant importance in the daily life of the coastal people because it is a great source of fishing: Both sail boats and trawlers operate in the bay.

The Bay of Bengal is an extensive and wide U-shaped basin that opens to the Indian Ocean. The base of the basin is a gently sloping southward plain dissected by sub-aqua valleys, trenches, and ridges. The bottom topography is prominently marked by the Java trench, Ganga trough, Ninety East Ridge, Eighty Five Ridge and Bengal Deep Sea Fan. The Bay of Bengal is dotted with numerous islands, including Andaman and Nicobar, Union Territory of India.

The annual average temperature of the surface water is approximately 88 degrees F (28 degrees C). The water temperature varies between 82 and 102 degrees F (25 and 35 degrees C) throughout the year. Several important and large rivers of India, Bangladesh, and Myanmar flow into the bay. The GANGES, Brahmaputra, and Meghna drain into the bay from the north. Mahanadi, Godavari, Krishna, and Cauvery, the Indian rivers, feed it from the west. The IRRRAWADDY RIVER of Myanmar flows into it from the east. "The rivers of Bangladesh [mainly the Ganges, Brahmaputra, and Meghna system] discharge the vast amount 1,222 million cubic meters of fresh water (excluding evaporation, deep percolation losses and evapotranspiration) into the bay" explains a Bangladeshi reference.

A constant addition of fresh water from the surrounding rivers essentially affects chemical and physical properties of the water of the Bay of Bengal. Owing to the dilution, river mouths have a very low salinity (1 to 5 percent) as compared to open water (32 to 34.5 percent). Salinity decreases away from the coast to the open water. It also varies with the season. Discharge of fresh water from the rivers adds nutrients to the bay, predominantly along the coastal belt, thus turning it into an important fishing ground. Important species are varieties of shrimp, flounder, and snapper. Overfishing is leading to depletion of the resource. The coastal reaches of the Bay of Bengal are being polluted continuously by oil traffic, effluent discharge, and chemicals used in agriculture. International cooperation is necessary to prevent such pollution.

Before the advent of steamships, the bay was used by fishermen, traders, and occasional conquerors using sail boats and monsoon winds that reversed directions during the summer and winter seasons. During the 16th and 17th centuries, Portuguese pirates operated in the bay, but later it was widely used by British and French colonizers. Using the bay, the British colonized all the countries adjacent to it except Thailand, thus turning it into a British lake. Three major ports used by the British were Calcutta, Madras, and Rangoon.

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## Beijing

BEIJING IS LOCATED in the northern part of the North China Plain, about 100 mi (160 km) northwest of the Bohai Sea. As capital of the People's Republic of CHINA, Beijing is the core of a special municipal district, giving the region political status equivalent to that of an entire province. For this reason, the city's area (6,489 square mi or 16,808 square km) is much greater than one might expect.

At the core of this "municipality" is the Beijing metropolitan area, which is surrounded by mountains on the west, north, and northeast, with flat plains extending to the south and southeast. Most of the remaining area beyond the metropolitan core is mountainous, with elevations ranging from 3,280 to 4,920 ft (1,000 to 1,500 m) above sea level. The city's highest point is 7,554 ft (2,303 meters) above sea level. Beijing has short springs; hot, humid summers; short, sunny autumns; and cold dry winters with 200 or so frost-free days annually. While the winters are long and cold, Beijing doesn't get much snow.

Because of the city's unique geography, with mountains to the west, north, and northeast, and onshore monsoon airflows, the weather is often punctuated by severe dust storms driven by very large high-pressure centers that form over northwestern China's deserts. Annual rainfall has been relatively low recently (14 in



or 36 cm in 2002), but the long-term average is around 16 to 18 in (41 to 46 cm) per year, making the area suitable for agriculture.

Historically, the Yongding, Chaobai, and Juma rivers have provided important water resources as they flow through mountains and southeastern plains toward the Bohai Sea. In addition to the three rivers, the city has relied heavily on waters from three major reservoirs located in the shelter of the surrounding mountains. But unlike the city's early years under the Yuan Dynasty, Beijing's major limitation today is water.

As the urban area expands in both size and population, increasing pressure is being put on the region's water resources, particularly groundwater resources. And because the surrounding lands provide most of the basic fruit and vegetable needs for the local population, farmers have had to resort to increased irrigation practices to maintain production levels. At the same time, the tremendous demand for land for industrial, commercial, and residential purposes, and the resulting expansion of the city proper, is leaving less and less land available for local agriculture and increasing the city's reliance on outside sources of food production. This increasing need for water from all sectors has led to increased use of groundwater stored in the aquifers beneath the city. But this use has a tremendous cost, particularly from a sustainability standpoint, if not managed properly.

Evidence from the archaeological record suggests that the lands now occupied by Beijing have experienced human presence for a very long time (dating back some 500,000 years to "Peking Man"). In these early years preceding the Yuan Dynasty (13th century), the area's geography was much different than what we see today, containing a rich and diverse wetland environment with numerous rivers, streams, and swamps. This rich wetland environment—with lush grasslands around its edges, surrounding mountains, and easy access to the high Mongolian Steppe and traditional homelands—was a factor for the Mongols in locating their capital (Dadu) at what is today Beijing.

Although serving off and on as China's capital beginning with the Liao Dynasty in 927, it is under the Mongols and their Yuan Dynasty that the city began taking on its present character. The Mongols undertook major ecological engineering projects, expanding and reconstructing the city's inner and outer walls, creating parks and gardens, and developing drainage projects to create local canals and waterways. It is also under the Mongols that the Grand Canal was extended

to the north, creating a vital food and communication link between Beijing and the heavily populated agricultural lands in the lower and middle Yangtze Basin to the south.

Beijing has served off and on as China's capital beginning in 927 with the Liao Dynasty, extending through the Jin, Yuan, and Ming dynasties until the end of the Qing Dynasty in 1911. After the overthrow of the Qing Dynasty in 1911, Beijing passed into the hands of various warlords until 1928, when it once again became the capital of China under the Nationalists (Guomindang).

Between 1937 and 1945, the Japanese occupied Beijing following their invasion of China. With the founding of People's Republic of China in October 1949, Beijing was once again designated as the capital, continuing its stature as the political and cultural center of China. However, when the communists established their rule in 1949, the government brought in more heavy industry (steelworks, textile factories, and machine factories) in an effort to make the city an industrial center as well.

The communists sought to make Beijing self-sufficient by expanding its territory to include outlying rural counties. After 1978, when the first economic liberalizations began, Beijing became a center of finance



*The Forbidden City, now a museum in Beijing, was the secretive political capital of China for centuries.*

as well. In the period following the reforms introduced by Deng Xiaoping in the late 1980s and early 1990s, Beijing's economic character has continued to grow and change. Today the interest is moving toward more high-tech industries with suburban office parks. There is exceptional growth in the insurance, real estate, and health care sectors of the economy, all fueling China's growing middle-class population.

In addition to being a political and cultural center, Beijing also thrives as a center of international activity and tourism. Great changes have taken place since the founding of the People's Republic of China in 1949. The city walls that once dominated the landscape in what is today the central business district have been demolished to facilitate transportation and allow for the expansion of residential and business sectors. Plans for future development are to retain the symmetrical layout of the old city on its north-south axis, extending out into the suburban districts. The overall plan covers an area of about 386 square mi (1,000 square km), with a traffic network of five concentric beltways, 28 radial roads, and underground and suburban railways to further link the city center with outlying areas and surrounding towns. With Tiananmen Square at the center, offices along Chang'an Boulevard (the city's main east-west corridor) will concentrate on state, political and economic affairs. The areas around the Palace Museum (Imperial Palace or Forbidden City) and city gates as well as the lakes have been designated landmark districts. And with a look to the future, an increasing number of historical and cultural sites are being renovated as the city prepares to host the 2008 Olympics.

At the end of 2002, Beijing had a total population of 14.56 million residents, 11.49 million of whom were registered as permanent residents. The remaining 3 million people make up a floating workforce with official permission to stay in the city and work temporarily or attend one of the city's 37 universities, most of which are in the Haidian District. The city's population geography is diverse, with all 55 of the recognized ethnic minorities within the population. As with all world capitals, there is a large expatriate community (about 20,000 people) throughout the city's core, giving the more frequented areas near tourist attractions, government offices, shopping districts, and university settings an interesting cosmopolitan feeling. Beijing is filled with major historic attractions. Some of the more familiar sites in Beijing, such as the Forbidden City, the Great Wall, Peking Man Relics, the Temple of Heaven, the Summer Palace, and the Ming Tombs are World

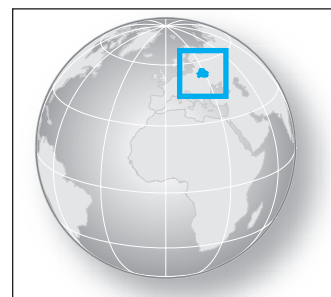
Cultural and Natural Heritage sites approved by the United Nations.

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## Belarus

**Map Page** 1132 **Area** 128,997 square mi (207,600 square km) **Population** 10,322,151 (2004) **Capital** Minsk **Highest Point** 1,135 ft (346 m) **Lowest Point** 295 ft (90 m) **GDP per capita** \$6,000 **Primary Natural Resources** forests, peat deposits, oil.



**BELARUS, FORMALLY BELORUSSIA**, also called White Russia, is bounded on the west by **POLAND**, on the northwest by **LATVIA** and **LITHUANIA**, on the north and east by **RUSSIA**, and on the south by **UKRAINE**. Ethnic Belarusians, who speak an East Slavic language closely related to Russian and Ukrainian, make up more than three-quarters of the population. Ethnic Russians are the largest minority group, followed distantly by Ukrainians and Poles.

Much of Belarus consists of flat lowlands separated by low hills and uplands. The highest point, Dzaryzhynskaya Hara, is only just over a thousand feet in elevation. Belarusian uplands were created during the last ice age. The limit of the last advance of the ice sheet lay across the country and is marked by a line of terminal moraines, known as the Belarusian ridge (Belaruskaya Grada).

This ridge runs west-southwest to east-northeast from the Polish frontier north of Brest toward Smalensk and consists of low, rolling hills. River valleys cut the ridge into a series of uplands, the sequence being: Hrodna upland, Vaukavysk upland, Schara valley, Navahradak upland, Nioman valley, Minsk upland, Biarezina valley, Dzvinia and Vitsebsk-Nieviel upland, Dnieper upland and a final group of uplands

along the eastern boundary. The highest group is the Minsk upland.

North and south of the ridge lie extensive lowlands. To the south lies the biggest Belarusian lowland called Paliessie, which is drained by the Prypiac River and its tributaries. The Prypiac River flows eastward to join the Dnieper River, which crosses the eastern part of Paliessie from north to south. In northern Belarus lie two more large lowlands: the Nioman lowland, drained by the river of that name, in the northwest, and the Polacak lowland, drained by the Western Dzvina, in the north. These two lowlands are separated by two morainic ridges, the Ashmiany and Svientsiany ridges, with the Viliya valley between them. The two northern basins contain many lakes of glacial origin, the largest of which is Lake Narach. Thus, Belarus falls into three main drainage basins, the Dnieper-Prypiac basin draining into the BLACK SEA, and the Nioman and Western Dzvina basins, draining into the Baltic Sea.

Forests cover about one-third of the country's area. The Belovezhskaya Forest, which straddles the Belarusian-Polish border, is home of the rare European bison, or wisent. The Pripet Marshes occupy much of southern Belarus. Belarus's continental climate is moderated by maritime influences from the ATLANTIC OCEAN and is characterized by cold winters, mild summers, and moderate rainfall. Much of the Belarus land is suited to crop production, especially fodder crops. Belarus is generally poor in mineral resources, but it does have sizable deposits of potassium salts at Soligorsk, south of Minsk, which provide potash fertilizer for export.

Belarus has clear evidence of early prehistoric settlement. Between the 6th and 8th centuries, Slavic tribes moved into the region, eventually forming local principalities that came under the sovereignty of Kievan Rus in the mid-9th century. The Mongols overthrew Kiev in 1240, and most of the Belarusian land passed to Lithuania, though Belarus retained substantial autonomy. Poland was united with Lithuania in 1386, and Belarus developed a largely Polish-speaking class of landowners. By the three divisions of Poland in the late-18th century, Russia acquired all of what became known under its rule as Belorussia.

From 1918 to 1921, Belorussia was fought over by the Germans, the Bolshevik government of Russia, and a reconstituted Poland, with the result that western Belorussia was yielded by the Bolsheviks to Poland. In the meantime, the Bolsheviks had in 1919 proclaimed a Belorussian Soviet Socialist Republic and in 1922 made it a part of Soviet Union. Finally, with the breakup of Soviet Union, the Belorussian republic gained inde-

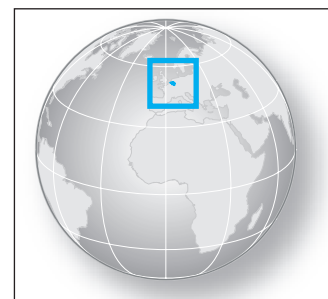
pendence in July 1990, and changed its name to Belarus.

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## Belgium

**Map Page** 1131 **Area** 11,790 square mi (30,510 square km) **Population** 10,289,088 **Capital** Brussels **Highest Point** Signal de Botrange 2,290 ft (694 m) **Lowest Point** 0 m **GDP per capita** \$29,000 **Primary Natural Resources** coal, natural gas.



ALTHOUGH IT OCCUPIES a central position at the economic crossroads of western Europe, and its people have been central in the development of European society for over a thousand years, Belgium as a state has existed only since the early 19th century. The Belgian people share much of their culture with their Dutch neighbors to the north but have been deeply affected by proximity to northern FRANCE and by important transportation links to GERMANY in the east. The result is a nation that is both divided between French and Germanic culture and language, and a model for interethnic cooperation that provides an ideal setting for institutions such as the NORTH ATLANTIC TREATY ORGANIZATION (NATO) and the EUROPEAN UNION (EU).

Belgium is one of the three countries known as the Low Countries, which occupy the northwestern edge of the North European Plain. As the name indicates, most of the territory of these countries—Belgium, the NETHERLANDS and LUXEMBOURG—is flat and close to sea level. Much of the area adjacent to Belgium's 40-mi



(66-km) North Sea coast is reclaimed land, protected from flooding by dikes and canals. The landscape becomes hillier in the central parts of Belgium and rises to low forested mountains in the southeast. This latter region is known as the Ardennes and is one of the largest areas of forest in western Europe. The Meuse River cuts its way through this wild part of the southeast, joined by its tributaries, the Sambre and the Ourthe, before passing into the Netherlands (as the Maas).

Further west, other large rivers cross Belgium, including the country's most important river, the Scheldet (Escaut in French), and its chief tributary, the Leie (Lys). But like the Meuse, the mouth of the Schelde is in the Netherlands, though the port city of Antwerp lies just a few kilometers inland. Antwerp is not only Belgium's most important port, it is the fourth-largest port in the world. Belgium's other port is Ostend, on the North Sea, connected to the Belgian interior via a series of canals. Other canals connect Antwerp to the Dutch ports of the lower Rhine, and the industrialized cities of the northwest to the mineral resources of the south and southeast.

The kingdom of Belgium is divided into 10 provinces: West Flanders, East Flanders, Antwerp, Flemish Brabant, Walloon Brabant, Hainaut, Namur, Limburg, Liège, and Luxembourg. Since 1993, it has also been divided into three regions—Flanders, the Brussels-Capital Region, and Wallonia—as well as three “communities,” one for each of the three official languages of the kingdom: Flemish, French, and German. These regions and communities roughly overlap but also have differences: The Brussels-Capital Region is an enclave within the Flemish-speaking region and is officially bilingual; the German-speaking population (less than 1 percent) live in several small towns close to the German border (the largest is Eupen). Flanders and Wallonia have roughly equal percentages of the land area, but Flanders has nearly twice as many people. This part of the country has one of the highest population densities in the world and includes some of Europe's most productive cities, including Bruges, Ghent and Antwerp. The French-speaking Walloon community is traditionally rural and less economically developed, resulting in some resentment that has threatened to break the country apart.

The unifying role of the monarchy and of the international position of Brussels as the “capital of Europe” goes a long way to ease this tension. As headquarters of NATO, the EU, and numerous other multinational corporations and organizations, Brussels has more resident foreigners (one in three), mostly diplomats and

journalists, than any other city in Europe. It is estimated that about 23,000 “Eurocrats” live in Brussels. Immigrants from North Africa and TURKEY also make up a sizable percentage of the population. In the past, Brussels has been a center for heavy industry, linked to the coalfields of Hainaut, Namur and Luxembourg, one of the areas first affected by Europe's INDUSTRIAL REVOLUTION in the early 19th century.

Cities such as Mons, Charleroi, and Liège were built on coal but have suffered greatly since the shift away from coal as a primary fossil fuel in the late-20th century. The steel industry in this area is also being shut down, further accentuating the economic disparities between the French-speaking south and the successful economic engines of the Flemish-speaking north.

Flanders has long been a center of industry and prosperity; the soil in this area is sandy and relatively unproductive, so the local inhabitants turned to trade and manufacturing. Bruges lace and Ghent woolen cloth were famous as early as the 14th century.

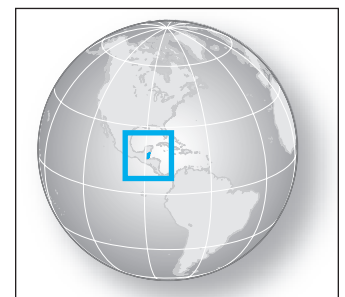
Today, this region is a leader in biotechnology and petrochemicals, but also continues more traditional trade in textiles and diamonds (Antwerp is the diamond trading capital of the world). Wallonia is now being developed as a center for agricultural innovations. Traditional specialties from all across Belgium include over 350 varieties of beer and rich chocolates.

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## Belize

**Map Page** 1136 **Area** 8,865 square mi (22,966 square km) **Population** 266,440 **Capital** Belmopan **Highest Point** 3,805 ft (1,160 m) **Lowest Point** 0 m **GDP per capita** \$4,900 **Primary Natural Resources** bananas, cocoa, citrus, sugar, fish.





BELIZE (“BELICE” IN SPANISH), formerly the Settlement of Belize in the Bay of Honduras (prior to 1862), British Honduras (1862–1973), and Belize thereafter, became independent on September 21, 1981.

Located on the Caribbean coast of northern Central America, it shares a northwestern border with the Mexican state of Quintana Roo, on the west with the Guatemalan department of Petén, and on the south with the Guatemalan department of Izabal. Honduras lies 46 mi (75 km) away at the two nations’ closest point across the Gulf of Honduras and CARIBBEAN SEA to the east. The current name is derived from the Belize River (also called the Old River) and Belize City, the country’s largest city, principal port, and former capital.

### BARRIER REEF

The eastern border has numerous marshy lagoons flanked by the world’s second-longest barrier reef (240 mi or 386 km). The nation is shaped like a rectangle extending 174 mi (280 km) north-south and about 62 mi (100 km) east-west, with a total land boundary length of 321 mi (516 km); the border with GUATEMALA is 165 mi (266 km) and with MEXICO 155 mi (250 km). Cay islands include about 266 square mi (690 square km), and the Hondo and the Sarstoon rivers define most of the northern and southern boundaries. The western border follows no natural features but runs north-south through lowland forest and highland plateau. The entire area of the country is slightly larger than EL SALVADOR or MASSACHUSETTS.

Geologically, Belize is divided into two primary physiographic regions, the Maya Mountains rising to 3,675 ft (1,120 m) and northern lowlands drained by 18 major rivers and streams. Most of Belize lies outside the tectonically active zone that underlies most of Central America. The climate is subtropical.

### POLITICS AND POPULATION

Belize was under the political control of a series of Maya city-states prior to the arrival of English colonists in the early 1600s. A 200-year territorial conflict between Britain and SPAIN became a conflict between Belize and Guatemala, from the independence of Spanish colonies into the 1990s. Modern Belize consists of six political districts (Belize, Cayo, Corozal, Orange Walk, Stann Creek, and Toledo); the new capital, Belmopan, is centrally located in the interior.

The country has a population that is fragmented into many racial and cultural groups. The two largest groups are Creoles; English-speaking or Creole-speak-

ing blacks and people of mixed African and European heritage, and Mestizos, Spanish-speaking people of mixed Mayan and Spanish European heritage. In addition there are Garifuna (Afro-Caribs originally from the Lesser Antilles), Maya (descendants of the original inhabitants), East Indians, Chinese, Arabs, and Europeans. English is the official language, but a local English dialect, Belizean Creole, is spoken by most groups; Spanish is widely spoken outside of Belize City. Other languages include Mayan dialects (Yucatecan, Mopán, and Kekchí), Garifuna, and Low German. Most Belizans are Roman Catholic, but there are significant Protestant minorities.

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## Benares

BENARES (also Banâras, Varanasi) is an ancient city in the state of Uttar Pradesh, in northern INDIA. Its population is just over 1 million (1991). Although the name *Benares* appears on many maps, it is actually a corruption of the official Indian name of the city, Varanasi. In addition to many religious institutions and festivals, the city is home to Banâras Hindu University, a major center of Sanskrit studies.

Hindus also call Benares the City of Light (Kâshî), as in “enlightenment,” because of its close association with the development of Indian spiritual life, a role it continues to play. There are approximately 1,500 Hindu temples and other religious buildings within the city limits. Its very location, on the western bank of a curve in the GANGES RIVER (Gangâ), is sacred in the minds of many Indians.

The basic geography of the city, with hundreds of temples and buildings crowding the western bank of the Ganges, facing an uninhabited floodplain on the eastern bank across the river, represents transcendence of this life to the “far shore” (the next life) to many believers. About a million believers a year make pilgrimages to the city of Benares, especially during annual

festivals. Most descend long stone steps (ghats) to immerse themselves in the holy waters of the Ganges.

The city is also a final destination for Hindus who hope to obtain salvation from the cycle of birth and death by dying in this sacred city. Although close association with death is usually regarded as inauspicious or even polluting in Indian society, because of the holy status of Benares, the regions of the city where bodies of the dead are cremated are especially revered.

Many Indians also bring the ashes of their dead relatives to Benares, where they are dispatched to the next world in the river's waters. City officials have recently supplemented the traditional wood-burning funeral pyres of the cremation grounds at Manikarnikâ downriver of the city with an electric crematorium at the Harishchandra Ghât, in an effort to reduce air pollution.

Though it has never been a seat of political authority, Benares is one of the oldest Indian cities, dating back at least 2,500 years, and has long been a site of Hindu worship. Other religions are also represented in the history of the city. It was at Deer Park just outside Benares where the Buddha made his first sermon (circa 528 B.C.E.). There have been many Muslims who lived and worshiped in Benares as well, and the mosque of the 17th-century Mughal Emperor Aurangzeb is found at the highest spot of the city.

Western visitors to India have been alternately fascinated and repelled by Benares for centuries. The city seemed to many Western visitors to encapsulate the exotic and sublime appeal of the East, with its mystical mood and myriad spiritual practices. On the other hand, the masses of humanity bathing in the polluted (if spiritually purifying) waters of the Ganges, as well as the worship of all manner of icons, shocked and offended other Western visitors.

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## Benelux

BENELUX IS THE name of the customs union created in 1956, named for the initial syllables of its three member states: BELGIUM, NETHERLANDS, and LUXEMBOURG. The name originally applied to the economic pact between the three countries, the Benelux Economic Union, but is now also used to refer to the three countries as a geopolitical entity. The goal of the customs union was to help rebuild the economies of the Low Countries after the devastation of World War II through the promotion of free movement of workers, capital, services, and goods between all three member states. The Benelux commission, with its headquarters based in Brussels, set about removing all barriers to free trade such as border tariffs and work permits.

The idea of a unified Low Countries is not new to the 20th century. In the Middle Ages, the entire region formed a collective economic unit under the Valois Dukes of Burgundy and their successors after 1477, the Hapsburgs. The 17 provinces of the Low Countries, plus the Duchy of Luxembourg, subsequently formed an essential part of the empire of Hapsburg Spain, the processing plant for boatloads of silver arriving each year from the New World.

Major cities like Ghent, Bruges, and Antwerp created industries and banking empires that rivaled northern Italy for the lead in the technological and economic revolution of the Renaissance. The breakup began with the revolt of the Dutch in the late 16th century. Their golden age in the 17th century was had mostly at the expense of their southern neighbors, who continued to be ruled by SPAIN, and then AUSTRIA until the 1790s. The three states were united once again at the end of the Napoleonic Wars, under the single rule of the Dutch, but this union lasted only 15 years, and the Belgians revolted against Dutch rule in 1830. A truncated Luxembourg remained attached to the Netherlands, however, until 1890, when it too became completely independent. Each maintained a strict policy of neutrality toward their larger neighbors.

The devastation of the two world wars, however, convinced the three states that going it alone would never secure the prosperity of all three countries. They had few raw materials, but abundant skilled labor, and easy access to the sea and major shipping lanes: Rotterdam and Antwerp are the largest and most active ports in Europe. Relatively small populations and highly productive industries meant all three were dependent on trade and international cooperation, stability, and peace. The impetus for their cooperation was the im-

portance of getting coal and steel from the hills of southern Belgium and Luxembourg, to the factories and ports of the Belgian and Dutch coasts as smoothly and efficiently as possible. A plan for the Benelux Economic Union was therefore formed by the governments of these countries before World War II was even over.

From their exile in LONDON, England (all three countries were under Nazi occupation), representatives of the three governments laid down the basic plan for the union in 1944, but it was not put into place until the formal signature of the Union Treaty at the Hague in 1958, by which time a larger group, inspired by the same principles, had also been created, the ECSC (European Coal and Steel Community), formed in 1952 by the three Benelux nations, plus West Germany, FRANCE, and ITALY.

This led to the formation of the European Economic Community in 1957, which evolved into the EUROPEAN UNION (EU) in 1993. The Benelux Customs Union served as a model for the creation of the EU, and many of its treaties and laws are simply extensions of Benelux policies. The Benelux nations were also founding nations of the NORTH ATLANTIC TREATY ORGANIZATION (NATO) in 1949, giving up their neutrality for stronger alliances with their larger neighbors.

Relations between the Benelux countries led to increased laxity in border crossings, eventually developing into the Schengen agreement of 1985, signed in the small town of Schengen, Luxembourg. This agreement removed most travel barriers for its original signatory nations, the Benelux countries, France, West Germany, Spain, and PORTUGAL, and now including additional EU members. One of the primary goals of the Benelux union was to pursue the development of Europe, and it continues to take common initiatives to stimulate integration.

Although the economic necessity for the union has mostly dissipated (coal and steel are no longer the power they were), the partnership is still useful, allowing these small states to coordinate their points of view so as to have the same weight as the larger, more populous nations of the EU.

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## Benguela Current

THE BENGUELA CURRENT is one of the world's four major eastern boundary currents. It flows northward off the coast of southwestern Africa along the western coasts of SOUTH AFRICA, NAMIBIA, and southern ANGOLA. The Benguela Current, along with the South Equatorial Current, and the northern part of the Antarctic Circumpolar Current make up the South Atlantic subtropical gyre. The Benguela Current draws icy-cold waters from the Southern Ocean and carries them northward along the coast of Africa. Because of these cold waters, rain clouds do not develop over the southwest coast of Africa, contributing to the parched climate of the KALAHARI and Namib deserts.

The Benguela Current is one of those regions off the west coasts of the continents where there is an upwelling of cool, nutrient-rich water due to the coastal edge of the continental shelf, the prevailing winds, and the Earth's rotation. Because of these nutrient-rich waters, there is a huge abundance of marine life of all kinds. This has resulted in a large and plentiful fishing industry off Africa's southwest coast. In direct contrast to this, there are areas of the Benguela Current off the coast of Namibia and along the Walvis Ridge in which there are no fish to be found. This is due to a buildup of harmful algae blooms and high hydrogen sulfide gas levels in the water that are toxic to marine life. This phenomenon is known as "red tide" and is usually confined to localized inshore areas, such as off the west coast of FLORIDA. But because of changes in wind direction, it can occur offshore in the Benguela Current.

About 93 to 124 mi (150 to 200 km) off the coast of South Africa, the Benguela Current begins with an upwelling of ocean currents. It spans from this area around 35 degrees south northward to between 14 degrees and 17 degrees south, where it meets the Angolan Current. At this northern boundary, the change is more dramatic, with cold and warm water meeting to form a thermal front along the coast. The Benguela Current covers around 57,915 square mi (150,000 square km) when using the continental shelf as the offshore boundary line.

The continental shelf near the Benguela is from 40 to 80 mi (64 to 128 km) wide. From the shelf, the ocean bottom slopes steeply away into the abyssal depths of the Cape and Angola basins, each about 16,400 ft (5,000 m) deep. These BASINS are separated by the Walvis Ridge, which starts just off the coast at about 20 degrees south and stretches to the west, linking up with the central Atlantic Ridge. The Walvis

Ridge rises to above 2,460 ft (750 m) in many places along its track. This area is exposed to persistent along-shore winds associated with a high-pressure weather system.

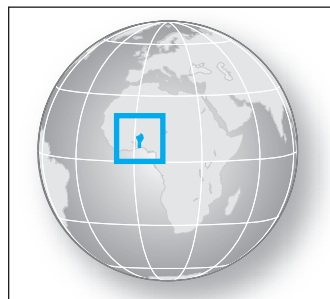
The surface temperatures of the Benguela Current are about 14 degrees F (8 degrees C) colder than average for coastlines in these latitudes. The coldest waters of the current run right along the coast of Africa, with very little seasonal variation except in the extreme south near Cape Town, South Africa, where the water is colder in the summer than it is in the winter. Surface temperatures average about 50 to 59 degrees F (10 to 15 degrees C) near the coast and reach up to 77 degrees F (25 degrees C) on the surface, out along the continental shelf.

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## Benin

**Map Page** 1113 **Area** 43,483 square mi (112,620 square km) **Population** 7,041,490 **Capital** Porto-Novo **Highest Point** 2,158 ft (658 m) **Lowest Point** 0 m **GDP per capita** \$1,100 (2003) **Primary Natural Resources** oil, limestone, marble, timber.



BENIN IS LOCATED in West Africa and is bordered to the west by TOGO, to the north by NIGER and BURKINA FASO and to the east by NIGERIA. It stretches 435 mi (700 km) from the NIGER RIVER to the Gulf of Guinea. Behind the southern coastal zone, there are a series of interconnected lagoons and lakes. Behind this coastal region is found an area of fertile clay soils that is generally flat, crossed by the wide marsh, through

which flows the Ouémé River. Northwest Benin is a region of forested mountains (the Atacora, highest point 2,150 ft or 655 m), from which the Mekrou and Pendjari rivers flow northeast to the Niger River (which is part of the country's northern border). The northeast is a highland region containing little fertile soil and covered mostly with savanna.

### POPULATION GROUPS

There are 42 ethnic groups in Benin, but its population is divided into four main ethnolinguistic groups: the Fon (in the south), the Yoruba (in the southeast near Nigeria), the Voltaic (in central and north Benin) and the Fulani (in the north). The country's official language is French. Almost three-quarters of the population follows traditional religious beliefs. Voodoo originated in Benin almost 350 years ago but was officially recognized only in 1996. About 15 percent of the Benin population is Muslim (mostly living in the north) and an equal number is Christian.

Benin's population is concentrated in the south and in rural areas. Most of the people engage in subsistence farming, with the main crops being cotton, corn, sorghum, cassava, beans, rice, peanuts, and palm oil. There is also an extensive freshwater fishing industry and a smaller sea fishing industry. Benin produces few manufactured goods, of which the largest are either processed agricultural goods (foods and beverages) or basic consumer items (textiles, footwear, ginned cotton). In 2002 the contribution of the agricultural sector to gross domestic product was 38 percent, while that of the industry was 15 percent and that of the service sector 47 percent.

Petroleum was discovered offshore of Porto-Novo in 1968, and in the 1990s was Benin's largest export. The other mineral resources found in the country (such as titanium, low-quality iron ore, ilmenite, and chromite) have not yet been extensively exploited. Apart from crude oil, the main exports are cotton, palm oil products, coffee and cocoa beans. The economy has been growing an average of 5 percent annually in the period 1991 to 2004, but rapid population growth has offset much of this increase. In 2001, 37 percent of the population was earning an income below the poverty line.

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## Bermuda

BERMUDA IS A UNITED KINGDOM overseas territory located 700 miles southeast of NEW YORK CITY in the North ATLANTIC OCEAN. With an area of 36.2 square mi (53.3 square km), the island colony has a population of 64,482 (2003). Bermuda is a primary tourism destination for East Coast Americans, and its capital, Hamilton, serves as a harbor for numerous cruise ships.

In 1506, a Spanish sea captain, Juan de Bermúdez, came upon uninhabited islands in the middle of the Atlantic Ocean and named them Bermuda. Although Bermúdez did not claim the land for SPAIN, the islands did become an important landmark for seafarers crossing the ocean from Spain to the New World. In 1609, an English admiral, Sir George Somers, was sailing from England to the new British settlement, Jamestown, VIRGINIA, in the New World. He landed in Bermuda and built replacement ships. Two men were left behind and claimed the land for Britain.

The British Jamestown Company soon became interested in the islands and three years later brought over 60 settlers to organize a settlement. Tobacco, cedar, whaling, and salt were vital to the early Bermudan economy. As the years passed, cedar forests were cleared for areas of land capable of cultivating potatoes, cabbages, onions, and tobacco.

Slaves were transported to the islands in 1616, and in 1684, Bermuda became a British colony. During the American Revolution, the Bermudan citizens remained loyal to the British, and in the War of 1812, the British navy used Bermuda as a base. The Royal Naval Dockyard on the western end of the island proved vital in maintaining British superiority in the North Atlantic. In 1834, slavery was abolished and around 5,000 slaves were freed. During the Civil War, Bermuda became a center for southern blockade-runner ships, which would attempt to break the Union naval blockade.

In 1874, the government of Bermuda and the Quebec Steamship Company agreed on a contract that created steamship service between NEW YORK CITY and



*Bermuda, a British dependency, is a tourist mecca for vacationers from the United States, especially those arriving via cruise ship.*

Bermuda. Bermuda was becoming a popular vacation destination for many people, including the famous American author Mark Twain, and the tourism industry expanded.

In 1937, Darell's Island Marine Airport was opened and air travel began to and from Bermuda. Six years earlier, a railroad was built in the territory. When World War II began, the strategic location of the islands proved vital. Part of the lend-lease agreement between Britain and the United States resulted in a portion of Bermuda being handed over to the American military. After World War II, women were allowed to vote and black voters were given greater freedom. A constitution was signed in 1968, which allowed for full self-government but left security and diplomatic affairs to the British.

The territory was affected by race riots throughout the 1970s, but in the 1980s, the construction industry prospered. Construction resulted in an incredible expansion and employment grew 34 percent. However, the economy faltered in the 1990s and many Bermudans called for full independence from Britain. In 1995, after only 58 percent of the electorate voted, a referendum failed to gain enough votes for independence. That same year, the naval bases occupied by the American military since World War II were handed back to the Bermudan government.

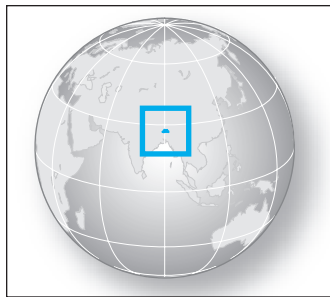
By 1998, the Progressive Labor Party's Jennifer Smith, was selected as the premier. She became the first woman and the youngest person to hold the post. In 2003, Alex Scott became premier. Bermuda is prospering economically and continues to attract a multitude of international companies and holiday seekers.

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## Bhutan

**Map Page** 1123 **Area** 29,204 square mi (47,000 square km) **Population** 2,139,549 (2004) **Capital** Thimphu **Highest Point** 24,780 ft (7,553 m) **Lowest Point** 318 ft (97 m) **GDP per capita** \$1,300 **Primary Natural Resources** hydropower.



BHUTAN IS A LANDLOCKED country located in the eastern part of the HIMALAYAN MOUNTAINS, bordered by INDIA in the south, east, and west and by TIBET in the north. At its lowest east-west corridor, Bhutan stretches around 186 mi (300 km), and it measures approximately 105 mi (170 km) at its north-south direction.

There are three main ethnic groups in Bhutan. The Ngalungs or Ngalops (often called Drukpas) live in the northwestern part of the country. They speak Dzonkha and are called Drukpas as they follow the Drukpa Kargyupa school of Tibetan Buddhism. The second ethnic group is called Sharchops and they inhabit the eastern and central region and practice Nyingmapa, a branch of Mahayana Buddhism. The Sharchops speak Tsangla, Kheng, Kurteop, Sharchopkha, and Brokpa dialects. The third major ethnic group is called Lhotshampas and they live in the southern foothills of Bhutan and speak primarily a Nepali language.

Bhutan is ruled by a hereditary monarch who governs the country with the support of a national assembly and the council of ministers. Bhutan does not have

any written constitution. In 2001, the Bhutanese king commissioned the drafting of a constitution, which is to become effective in 2005. The royal government of Bhutan is guided by the aid and advice of the government of India in regard to its external relations. India is responsible for defense and foreign relations as per Article 2 of the Indo-Bhutan treaty.

Bhutan is primarily an agricultural country. The traditional form of agriculture is the main subsistence occupation for the majority of Bhutanese people, who involve themselves with agriculture, livestock, and related activities. The hydroelectricity power sector provides the single biggest revenue to Bhutan. India has been the prime market for Bhutan's finished products and imports. Bhutan imports from India necessary household items such as rice, vegetables, poultry, fish, wheat, and salt. Bhutan also imports other items such as petroleum products, automobiles, steel, sugar, medicines, and textile goods.

Bhutan has been identified as one of the 10 biodiversity hot spots in the world and as one of the 221 global bird areas. Its ecosystems harbor some of the most endangered species of the Himalayas, with an estimated 770 species of birds and over 50 species of rhododendron. They are enriched by a rich a wildlife with animals such as the snow leopard, golden langur, blue sheep, water buffalo, tiger, and elephant.

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## Bight of Benin

A "BIGHT" REFERS TO a bend or curve, most often a crescent shape, that forms an open bay in a coastline. The Bight of Benin is a roughly 500-mi- (800-km-) long bend in the West African coast, stretching from near the mouth of the Volta River (Cape Saint Paul) in GHANA eastward across the coastlines of TOGO and BENIN to the DELTA of the Niger River in NIGERIA. The Bight of Benin received its name from the centuries-old kingdom of Benin located in southern Nigeria. The na-

tion of BENIN (formerly Dahomey) consequently received its name from the coastline in 1975.

The Bight of Benin is a region rich in culture and history. Prior to European colonization, major African kingdoms existed in the area, including the Asante (1750 to late 1800s) in what is now Ghana, Fon (1700s) and Dahomey kingdoms (1800s) in what is now Togo and Benin, and the Yoruba (1000s to 1800s) and Benin (1200s to 1897) kingdoms in what is now Nigeria.

Portuguese explorers, reaching the area in 1485, found the city of Benin to be as well organized as cities in Europe. Between 1500 and 1800, the Benin kingdom expanded power, largely through trade with the Portuguese. The tropical climate brought hardship to Europeans from disease and trying conditions. An old rhyme stated, "Beware, beware the Bight of Benin, for few come out though many go in."

Also known as the Slave Coast, the region was an important area of slave trading from the 1500s to the 1800s. Some pre-European slavery was practiced, largely as prisoner labor resulting from wars among kingdoms. Slavery expanded with European contact, with mostly males sent abroad and females staying within Africa. The Dahomey kingdom became a major source of transatlantic slave trade to BRAZIL, the Caribbean, and the UNITED STATES. The kingdom was the origin of an estimated 14.5 percent of U.S. slaves. The cities of Abomey and Ouidah became international cultural and trading centers.

Many slaves spoke the Gbe language and practiced the religion of Vodun (a predecessor of Haitian voodoo). As many as 10,000 to 15,000 slaves were exported per year. By the early to mid-1700s, so many local slaves were exported that prices rose and other African regions to the west and south were exploited. King Duezo of Dahomey brought independence from the Yoruba in the early 1800s. Abolition of slavery in Brazil in 1880 brought liberated slaves back from Brazil. Many were skilled tradesmen who formed an upper class in Porto Novo and Lagos, bringing some Portuguese architecture that had been popular in colonial Brazil.

Palm oil then became the major regional export until petroleum oil was discovered in the Niger River delta in the 1950s. Cotton and cocoa are also major exports. The coastal population today includes the nations of Ghana (former British colony, 20 million), Togo (former German and French colony, 5 million), Benin (former French colony, 7 million), and Nigeria (former British colony, 130 million).

The Bight of Benin has a long dry season from November to the end of March, driven by northerly Harmattan winds. It has a first rainy season from April to July, a short dry period in August, and a second rainy season in September and October. Rainfall can exceed 10 in (25 cm) in June and 50 in (127 cm) annually. Average temperatures range from lows of 75 degrees F (23 degrees C) to highs of 85 degrees F (28 degrees C) in the wet season and 90 degrees F (32 degrees C) in the dry season.

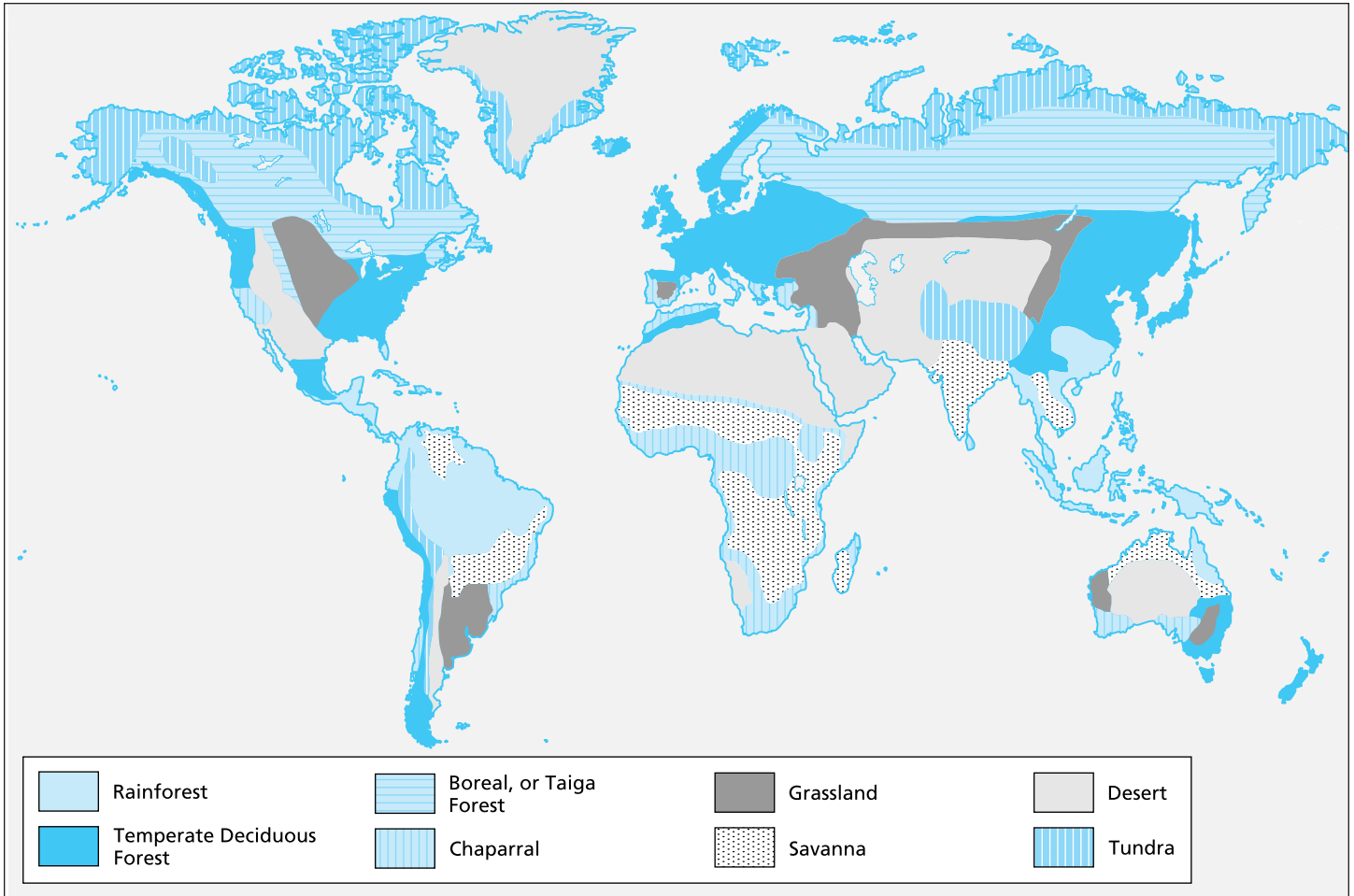
Major ports include Lomé (Togo), Cotonou (Benin), and Lagos (Nigeria). Ouidah was the only port in Benin until 1908. Ouidah today features a voodoo museum, the Sacred Forest, and Route of the Slaves, a short road with landmarks, statues, and villages along the route slaves took to the ships. North of Cotonou is Ganvié, a town of bamboo huts built on stilts for protection. Religious custom prevented Fon and Dahomey warriors from crossing into water. Much of the Bight of Benin coastline has white sand beaches, clear water, tidal flats, and coastal lagoons, accompanied by strong tides and currents.

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## biome

A BIOME IS A classification of large areas of plant formations. The world's vegetation communities can be described in many ways depending on scale and controlling factors. The early plant geographers, notably F. E. Clements and V. E. Shelford, working in the UNITED KINGDOM and the UNITED STATES in the early 20th century, defined and classified the major plant formations with their associated fauna as biomes. Within each biome, there is a uniform life form of vegetation, for



*The biomes contain a wealth of natural resources that have sustained humankind and allowed the species to proliferate, but at a cost. Many human activities are contributing to ecosystem loss and species extinction.*

example, FORESTS and GRASSLANDS in which trees and grasses predominate respectively. All biomes are extensive and characterize large areas of the Earth's surface. Further subdivisions are possible; for example forests can be divided into coniferous, temperate, and tropical, and grasslands may be temperate or tropical. These subdivisions are usually linked with the prevailing climate because the annual temperature and precipitation regimes are important determinants of vegetation life form and species composition, which, in turn, influence animal communities. Thus, in traditional terms biomes are climatic climax communities, that is, they comprise plant and animal communities that have developed an equilibrium with their environment which facilitates definition as a unit.

There are rarely sharp boundaries between biomes but rather a gradation in a transition zone, similar to an ecotone, or boundary between ECOSYSTEMS, which can also be synonymous with biomes at the global

scale. The major biomes recognized on the Earth's land surface include the following:

1) TUNDRA: High latitudes, no trees, dwarf shrubs, herbs, grasses.

2) Forests: Taiga (coniferous forest) in high latitudes, evergreen tree species predominate; temperate forest: temperate latitudes/high latitude maritime, broadleaf species; temperate RAINFOREST: same as temperate forests above, especially Southern Hemisphere island locations, evergreen and broadleaf species; tropical forest: tropical latitudes with high rainfall, varied composition with evergreen and broadleaf species.

3) Savanna: Various types depending on tree/grass distribution, tropical latitudes with seasonal rainfall, grasslands to open forests.

4) Mediterranean-type: Sometimes described as chaparral, various types in areas of hot, dry summers and warm, wet winters, between temperate and tropical latitudes; mixed woodland, grassland, shrubs.



5) Grasslands: Various types, mid-latitude continental interior with a wide annual temperature range, grass species predominate.

6) DESERT: Highly variable, depending on precipitation volume and distribution, low latitudes with low rainfall, few trees and shrubs, ephemeral herbs and grasses, includes succulents.

Aquatic environments can also be classified into biomes, notably wetlands, freshwater environments, and marine ecosystems. The first two categories can be further subdivided depending on characteristics such as climate, acidity, alkalinity, and salinity. Marine ecosystems can be subdivided into two units: the LITTORAL or shoreline zone and the oceanic or open water zone. Examples of littoral ecosystems include mangrove swamps and salt marshes. The oceanic zone also varies roughly on a latitudinal basis reflecting water temperature and, hence, the prevailing climate.

An alternative classification can be applied to the vertical distribution of marine organisms, namely, the illuminated or photic zone near the surface, where light allows photosynthesis to take place; the nectonic zone, in which fish and aquatic mammals live; and the ocean floor, which may be rock, sand, or mud, where bottom-dwelling organisms (benthos) live.

The distribution and composition of biomes are not constant in geological time. Throughout the 5,000 million years of Earth history, changes in climate and earth movements have altered the configuration of the continents and the oceans. Evolution has given rise to new life forms. The most geologically recent alterations to the world's biomes occurred during the last 3 million years, the last Ice Age, when a series of cold periods (glacial stages) separated by warm (interglacial stages) began.

As temperatures waxed and waned, the world's biomes changed in extent and in composition. The biomes described above came into existence between 10,000 and 5,000 years ago during the current interglacial stage. The present biomes have also been substantially modified by human activity for which there is no precedent in earlier geological periods. The biomes contain a wealth of natural resources that have sustained humankind and allowed the species to proliferate, but at a cost. Agriculture, mining, logging, pollution, urban spread, tourism, and water extraction are all contributing to ecosystem loss and species extinction.

This alteration is also impairing the capacity of the biomes to provide essential services such as the circulation of elements and compounds between the atmos-

phere, vegetation, and soils, as in the carbon and nitrogen cycles. This is related to the regulation of climate as vegetation, especially trees, provide a huge store of carbon. But as deforestation occurs, increasing volumes of carbon enter the atmosphere as carbon dioxide and so exacerbate the problem of global warming caused by fossil-fuel consumption.

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## bioreserve

BIOREServes, also known as BIOSPHERE reserves, are an internationally recognized type of conservation reserve. In 1970, the 16th General Conference of UNESCO (part of the United Nations), acting on the recommendations of the conference, launched the long-term intergovernmental and interdisciplinary program known as Man and the Biosphere (MAB). Crucial for the program was a project for the conservation of natural areas and of the genetic material they contain, which included the development of a coordinated worldwide network of protected areas, linked by international understanding on purposes, and standards, and exchange of scientific information.

These include biosphere reserves that contained representative land and coastal areas of each of the major or otherwise relevant ECOSYSTEMS within a nation's boundaries. The biospheres could be used as basic logistical resources for research, as areas for education and training, and as essential components for the study of many projects under the overall program, including a role of benchmarks or standards for measurement of long-term changes in the biosphere as a whole.

In the design of criteria for the identification of biosphere reserves, special attention was paid to the embodiment of ecological and genetic principles of nature conservation, and thus the shape and size of reserves were considered important. In addition, criteria were determined for establishing a network of base-

line monitoring stations in representative undisturbed biome areas throughout the world to serve as benchmarks or standards for assessing change. Unlike many other forms of conservation reserve, biosphere reserves are intended to not only include natural ecosystems within national parks and wilderness areas but also seminatural systems, including, for instance, those maintained by long-established land-use practice. Each biosphere reserve should include one or more of the following categories: representative examples of natural biomes; unique communities or areas with unusual natural features of exceptional interest; examples of harmonious landscapes resulting from traditional patterns of land use; and examples of modified or degraded ecosystems capable of being restored to more natural conditions. Each biosphere reserve should be large enough to be an effective conservation unit with long-term legal protection and to accommodate different uses without conflict. In some cases biosphere reserves coincide with or incorporate existing or proposed protected areas, such as national parks, sanctuaries, or nature reserves.

Biosphere reserves are divided in up to four management zones:

A natural or core zone managed for minimum human interference, to serve as a baseline for the biological region and in which research, educational and training activities are carefully controlled and must be nonmanipulative.

A manipulative or buffer zone managed for research, education, and training activities, where manipulative methods and techniques are permitted. Traditional activities including timber production, hunting, fishing, and grazing, are permitted in a controlled manner.

A reclamation or restoration zone managed to study and reclaim lands and natural resources where heavy natural or human-caused alteration have passed ecological thresholds, where biological processes have been interrupted, or where species have become locally extinct.

A stable cultural zone managed to protect and study ongoing cultures and land use practices that are in harmony with the environment, including traditional land-use practices of indigenous peoples. In this zone local residents and their activities continue, but new technologies may be strictly controlled in order to minimize unwanted impacts.

Where it is not possible to have all the elements of the biosphere reserve in close contact with one another, a cluster arrangement of the components is permissi-

ble. However, it is still vital that other essential criteria are met, including adequate legal control, manageability and buffering of the core area. The concept of a core area is adapted to protect marine elements within a coastal biosphere reserve. A marine buffer zone can be established to help preserve marine core areas, as in the case of the zoning plan for the GREAT BARRIER REEF biosphere reserve in AUSTRALIA. Many biosphere reserves have been declared; nominations are approved by the International Coordinating Council of MAB.

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## biosphere

THE ENVIRONMENT of the Earth can be broadly divided into four major systems: the atmosphere, hydrosphere, lithosphere, and biosphere. Russian scientist Vladimir Vernadsky coined the term *biosphere* in 1929. The term refers to the life zone of Earth that includes the air, land, and water occupied by all organisms including humans. This life zone distinguishes our planet from all others in the solar system.

The biosphere fulfills several important functions and processes to sustain life. These processes include the ways that solar energy and PRECIPITATION control biotic productivity, the interactions among various life forms, and how life forms have spread over the Earth's surface and adapted to various habitats. These processes are not limited to only the biosphere, but are the result of complex interactions between all the major systems (the atmosphere, hydrosphere, and lithosphere).

For example, the biosphere is both a source and sink for several important atmospheric trace gases and environmental pollutants (methane and nitrous oxide, for example). It is an essential factor in determining the budget, abundance, and distribution of trace gases in

the atmosphere. Different types of forests create different atmospheric conditions that influence climate and ecosystem functioning. Chemical reactions critical to both life and atmospheric processes include photosynthesis and respiration.

Water is essential for all living organisms, and the biosphere plays a crucial role in the transportation, transformation, and redistribution of water on local and regional scales. In terrestrial ecosystems, vegetation plays the primary role in transferring water from the soil to the atmosphere. The biota exerts measurable effects on water quality through recycling of nutrients and absorption of air and water pollutants. Biospheric processes are also evident in the lithosphere. Root growth and the generation of organic acids aid in chemical and mechanical weathering of soils and geologic materials. Decomposition of organic material add nutrients to the soil.

The biosphere is based on the hierarchical concept of a food chain. Primary producers (plants), herbivores, carnivores, and decomposers all interact to create food chains. Organisms are linked to their environment and their relationships with other organisms as energy and mass are transferred from one level of the food chain to another. All life is dependent upon the first tier of the food chain, the primary producers or plants. The amount of new energy acquired by plant life in a given time is the primary productivity of that unit.

The biosphere can be divided into distinct ECOSYSTEMS based on the interactions between organisms, the local food chain and their habitat and measured in primary productivity. This creates geographically diverse areas in the form of different physical environments (ecoregions), physiognomic types (BIOMES) and floristic and faunistic (biogeographic) zones. Primary productivity influences the number and type of animals that can live in a particular area. The quantity and variety are greatest where conditions are best for plant growth but decline under harsher conditions. The variety of these natural areas are represented by mountains, plains, coastal regions, islands, inland forests, deserts, tropics, tundra, polar areas, and oceanic realms.

Humans are also part of the biosphere. Human activity and impacts have led to changes in habitat and a reduction in biodiversity. Biosphere reserves have been created to demonstrate integrated management of land, water, and biodiversity in a coordinated network of protected areas. These reserves are characterized by a diversity of plants, animals and microorganisms and healthy natural ecosystems integrated with human sys-

tems and activities. Addressing the relationship between natural processes and human activities has been a critical aspect of understanding sustainable use by humans of the biosphere.

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## Black Sea

THE BLACK SEA IS a body of salt water that stretches 630 mi (1,014 km) from east to west. TURKEY faces its southern shore, BULGARIA and ROMANIA lie west of the Black Sea, and UKRAINE, RUSSIA, and GEORGIA border it to the north, northeast, and east, respectively. The Black Sea stretches 330 mi (530 km) from north to south, except between the Crimean Peninsula and Turkey, where it cinches to 144 mi (232 km).

From the southwest, the Bosphorus connects the Black Sea to the Sea of Marmara, and to the north, just east of the Crimean Peninsula, the Kerch Strait leads to the Sea of Azov. The CAUCASUS MOUNTAINS line the northeastern edge of the Black Sea; the Pontic Mountains are to the south. The Black Sea is usually considered the boundary between Europe and Asia. At its deepest point, the Black Sea reaches a depth of 7,218 ft (2,200 m). It has an area of 262,840 square mi (683,000 square km). Below 660 ft (200 m), the water holds no oxygen, and the Black Sea is therefore the largest anoxic basin in world, with about 90 percent of its water permanently anaerobic. The Black Sea figures in myth and history, dating back thousands of years. In the *Voyage of the Argonauts*, Jason sails through the narrow Bosphorus, with shifting walls that threaten to crush his ship, into the Black Sea.

The sea, named "black" by the Turks for its storms, was the trade passage to Asia for the Egyptians and Greeks. It was important to the growth of Byzantium (now Istanbul) from 600 B.C.E. through the time of the Crusades, when the Byzantine Empire was finally destroyed. The Ottoman Turks controlled the Black Sea from 1453 to 1774.



Some evidence exists that the modern Black Sea was formed during a massive flood, perhaps Noah's flood.

Over 160 million people live in the area of the Black Sea, and it serves as a thoroughfare for oil tankers and other vessels. The sea's anoxic nature aggravates problems of pollution. The countries bordering the Black Sea, as well as the NORTH ATLANTIC TREATY ORGANIZATION (NATO) and other groups, are identifying the problems and proposing improvements in the ecosystems of the region.

In the 1990s, two geologists at Columbia University in New York City, William Ryan and Walter Pitman, proposed a new theory: that the Black Sea had been a freshwater lake until 5000 B.C.E. The MEDITERRANEAN SEA swelled, flooded northward over Turkey, and funneled through the Bosphorus Strait with an impact greater than 200 times the force of Niagara Falls. During this flood, which is recalled in the Bible, the Gilgamesh Epic of Sumer, and other ancient stories, the Black Sea rose at a rate of 6 in (15 cm) a day. Dr. Robert Ballard, discoverer of the *Titanic* remains in 1986, headed an exploratory team in 1999 and 2000 that found evidence of an ancient shoreline 550 ft (168 m) below the current level of the Black Sea. Preliminary dating of sediment supports the flood theory of Williams and Pitman, and Ballard has also found ancient river channels and the remains of a wooden structure 311 ft (95 m) below the current surface.

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## Bokkara

**BOKKARA (ALSO BUKHARA)** is a city that lies on the SILK ROAD of Central Asia in the Asian republic of UZBEKISTAN. Its name, bestowed by its Sogdian occupiers in the 3rd century B.C.E., derives from the Sanskrit word *vikhara*, meaning "monastery." Bokkara lies in the ARAL SEA basin and was founded some 3,000 years ago by the Persian Prince Siyavush of the Syavushid dynasty on a hill in the Kyzyl Kum, a desert region in the northern foothills of the Pamir/TIAN SHAN MOUNTAINS. It enjoys a continental climate of cold winters and hot summers. The annual temperature regime varies from 5 degrees F (-15 degrees C) in January to 126 degrees F (52 degrees C) in July and receives less than 8 in (20 cm) of precipitation per year.

Culturally, Bokkara has experienced many influences because of its location at the crossroads of Asia. The Achaemenids of Persia captured Bokkara 2,600 years ago, it was taken by Alexander the Great in 329 B.C.E., and then by the Sogdians from the Fergana and Zerafshan valleys to the east. At this time, Zoroastrianism, a belief system involving fire worship, was practiced. However, with the arrival of the Arabs, the city changed and ISLAM was introduced.

### ISLAMIC LEGACY

This Islamic legacy is apparent today in the form of mosques, *madrassas* (Islamic schools), and the minarets, palaces, and mausolea of the ruling elite and their successors, the Samanid dynasty. In the early 13th century, the Mongols, led by Genghis Khan, invaded and destroyed much of Bokkara. In 1500, the Uzbek people claimed Bokkara, routing the descendants of the great Tamar (also Amir Timur and Tambulaine) who had established his capital at SAMARQAND in the early 1400s.



The decorative arts were encouraged, especially miniatures, and the restoration of Bokkara's ruined buildings commenced. The city benefited from overland intercontinental trade as commerce was established between eastern Asia and western Europe. Various wars and rivalries then led to a decline in the city's fortunes until the 1800s when British and Russian interests were revived as they vied for influence and attempted to reestablish trade.

### SOVIET ERA

Tzarist interests caused another twist in Bokkara's history, and that of the region in general. Russian interest intensified, though Bokkara never formally became part of the empire until the advent of the Soviet era in 1924, when Uzbekistan, as a political unit of the Soviet union, was created. Cultural change was generated through education, but the underlying traditions of Bokkara were never extinguished. Commerce and trade remained important and Islam remained the chief religious influence. Even though many of the ancient mosques were closed by the Soviets, they were not destroyed. Today, in the independent, post-Soviet era, the monuments associated with Bokkara's rich history provide the attraction for a growing tourist industry, and many are working mosques once again.

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## Bolivia

**Map Page** 1139 **Area** 424,164 square mi (1,098,580 square km) **Population** 8,586,443 **Capital** La Paz **Highest Point** 21,463 ft (6,542 m) **Lowest Point** 295 ft (90 m) **GDP per capita** \$2,500 (2002) **Primary Natural Resources** tin, natural gas, petroleum, zinc.



BOLIVIA IS A COMPLEX and fascinating country. Located in the center of South America, it shares bor-

ders with five countries: ARGENTINA, BRAZIL, CHILE, PARAGUAY, and PERU. After the War of the Pacific (1879–84) against Chile, Bolivia lost access to the PACIFIC OCEAN and became, along with Paraguay, one of the two LANDLOCKED states in the Americas. Since then, the question of Bolivia's access to the sea has remained a central diplomatic and economic issue in the region. In addition, in 1935, during the Chaco War against Paraguay, Bolivia lost substantial claims to the Chaco territory.

Bolivia is a contradictory country. While it is extremely rich in natural resources, including some of the largest reserves of natural gas and tin, it has acute social and economic tensions. The country's economic vulnerability, its cycles of boom-and-bust, and its traditional dependence on the external market have intensified social inequality. At the beginning of the 21st century, with two-thirds of the country's population living in poverty, a third of which falls below the poverty level, Bolivia is one of the poorest nations on the continent. After a short period of economic growth in the 1990s, the economy slowed down as result of the Asian economic crisis, and social and political tensions have consistently increased.

Geography and the environment have shaped the history of Bolivia. Bolivia has three distinctive geographical regions: the highlands or ALTIPLANO (high plateau), the transitional sub-Andean, and the tropical lowlands. The majority of the Bolivian population has historically lived in the Altiplano, between 12,000 ft (3,657 m) and 13,000 ft (3,962 m) above sea level. The altitude has posed enormous challenges.

In pre-Columbian times, the Andean poor soils, high altitude, and harsh climate forced the population to develop new agricultural techniques and domesticate the American cameloids (llama and alpaca). On the eve of the Spanish conquest, the Bolivian Andes produced about 200 kinds of potatoes. The highlands have provided essential mineral resources including one of the richest silver mines in the world, Potosí. The Altiplano also has the world's highest navigable lake, Lake TITICACA (12,483 ft or 3,805 m), which Bolivia shares with Peru. The valleys of the transitional sub-Andean region have been a significant source of agricultural products and the basis of a peasant tradition.

Despite the image of Bolivia as an Andean country, about two-thirds of its territory is tropical or semi-tropical. Access to the tropical lowlands, however, has been traditionally difficult, limiting the demographic growth and the exploitation of economic resources. In the late 19th century, the exploitation of rubber created



*La Paz is the de facto capital of Bolivia and where the seat of government is located.*

an economic boom in the area, and since the last decades of the 20th century, the development of commercial agriculture, including products such as sugar, cotton, and cattle, have promoted enormous growth. Today, the tropical regions and its major city, Santa Cruz de la Sierra, are among the fastest-growing areas in the country.

Since the mid-1950s, Bolivia has become an increasingly urban country, and today about 62 percent of the population lives in cities. While Sucre is the official capital, La Paz is the de facto capital and the seat of the government. La Paz has an estimated population of 793,293 people, and El Alto, a former suburb of La Paz, has about 649,958 residents and an annual growth of 5.1 percent. Santa Cruz de La Sierra, located in the tropical eastern lowlands, has become in the last decades an important urban and economic center, and today it has an estimated population of 1,135,526 and an annual urban growth of 5.08 percent.

Bolivia is a multiethnic society. About 55 percent of the population is considered of native origin, 30 percent of which is Quechua and 25 percent Aymara. The native heritage has shaped popular culture, traditions, folklore, festivals, language, and religious practices. Another 30 percent identified themselves as mestizo or *cholos*, an ambiguous category that refers both to people of mixed race as well as acculturated natives who live in urban environments, speak Spanish, and have abandoned native customs and dress. Only approxi-

mately 15 percent of the Bolivian population is classified as white.

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## Bordeaux

BORDEAUX IS THE eighth-largest city in FRANCE, and the capital of the historic southwestern province of Aquitaine. Bordeaux is also considered the wine capital of the world, and has been famous for its viticulture since the days of the Roman Empire. Unlike other major French cities, Bordeaux is not known for its energetic lifestyle or major industrial output; instead, the Bordelais take pride in their region's more relaxed pace of life and the spirit of elegance and refinement that characterizes much of the city and the region.

The city of Bordeaux arose as a Gallo-Roman port (Burdigala) on the river Garonne at the head of the large estuary the Gironde, which flows into the ATLANTIC OCEAN about 56 mi (90 km) to the northwest. It became the chief city of Aquitaine from the early Middle Ages, before this region became part of the kingdom of France. In fact, from 1152 to 1453, Bordeaux was an English city, the jewel in a string of French possessions held by the English kings until they were finally chased out at the end of the Hundred Years' War. Even after this date, Bordeaux remained the chief supplier of wine to England and other northern European states.

The city's wealth continued to grow with the development of Atlantic sea trade in the 17th century, primarily through the growth of refineries for sugar, which arrived in Bordeaux's ports directly from France's colonies in the West Indies. Revenues from the sugar and wine industries reshaped the city, which underwent a massive urban renewal in the 18th century, resulting in much of the city's present appearance, notably the Place Royale (today's Place de la Bourse) and the Grand Théâtre.

Today's Bordeaux is a varied mixture of medieval churches, 18th-century squares, and more modern de-

velopments such as the massive suspension bridge across the Garonne, the Pont d'Aquitaine, opened in 1967. Several Gothic churches dominate Bordeaux's skyline owing to a general lack of skyscrapers. Notable among these is the Cathedral of Saint-André and the basilicas of Saint Seurin and Saint-Michel, all three of which were declared United Nations World Heritage sites in 1998 as important stops on the pilgrimage routes to Santiago de Compostela. Renaissance and neoclassical buildings include the Grosse Cloche, a tall clock tower that is one of the symbols of the city, and the Palais Rohan, the former archiepiscopal palace and now the city hall. Louis XV residences in Bordeaux are among the finest of French architecture.

In 2000, a plan was introduced to renovate the Garonne quaysides, which stretch for miles in a graceful unified arc along the curve of the river. City improvements such as this continue to be funded by wine revenues. Bordeaux's 57 different appellations (varieties) of wine are produced on roughly 20,000 acres (8,000 hectares) of surrounding countryside by 3,000 independent chateaus, 60 wine cooperatives, and the city's 400 wine merchants. The city's population is nearly 219,000 (1999). Many residents are occupied in some form with the wine industry but increasingly are also employed in aeronautics and aerospace technologies and the manufacture of chemical and pharmaceutical products.

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## Borneo

THE ISLAND OF BORNEO is the largest island of the Malay archipelago and the third-largest island in the world (after GREENLAND and PAPUA-NEW GUINEA), covering 287,420 square mi (736,974 square km). It is also one of the least explored places on Earth and retains much of the mystery for today's tourists that it did for anthropologists and adventurers of the 19th century. Borneo is not a single political unit; rather, it is

divided among three countries: 72 percent of the island, known as Kalimantan, is a province of INDONESIA. The rest forms the two eastern provinces of MALAYSIA, Sabah and Sarawak, plus the small independent sultanate of BRUNEI.

Unlike most of its island neighbors, Borneo is not entirely volcanic in origin, but formed of ancient igneous rock. It is seen more as an extension of the continental landmass of Southeast Asia, separated only by the Sunda Sea, which is very shallow (656 ft or 200 m) and was probably dry land in the geologically recent past. This is in contrast to the deep plunges of the waters to the east and south of the island, the Sulu and Celebes seas, and the Selat Makasar.

Borneo is crossed by two main mountain chains, which roughly divide the island into four watersheds. Three of these cover Kalimantan, while the fourth, that of the northwest, waters Sabah, Sarawak, and Brunei. The main range, like a backbone, crosses the island diagonally from southwest to northeast and consists of the Kapuas and Iran ranges—which form the boundary between the Indonesian and Malaysian parts of the island—continue in the south as the Schwaner range. These ranges have several peaks over 6,600 ft (2,000 m), but the highest mountain on the island (and in Southeast Asia), Kinabalu (13,533 ft or 4,101 m), stands on its own at the far northern point of the island. The volcanic Kinabalu is one of the leading spots in the region for tourists, drawn to its hot mineral springs and exotic wildlife, including the Rafflesia, the largest flower in the world (up to 66 in or 170 cm in diameter).

The coasts are almost entirely alluvial and swampy, especially in the south and southeast. This area is one of the best watered in the world, with frequent rains and numerous rivers and streams. But most are obstructed by mud and vegetation, and navigation for larger vessels is hindered by swamps at most river mouths, spreading across vast DELTAS, some reaching up to 70 mi (113 km) across. During the rainy season, for example, the Barito River in the southeast covers a delta of roughly 11,000 square mi (28,000 square km).

The equator cuts directly across the island, and its vegetation reflects this geographic position. Most of the area is covered with thick forests and dense vegetation. The forests contain valuable tropical hardwoods like teak, ebony, and sandalwood, the best camphor in Asia (a tree resin used to make medicines), and spices such as nutmeg, ginger, cinnamon, clove, and pepper. The forests also contain many large wild animals, such as the Asian elephant, gibbon, tapir, the giant python



(which grow up to 20 ft), and the so-called man of the forest, the orangutan. Deforestation is a serious problem, however, causing both erosion and loss of habitat for these increasingly rare animals. Especially bad in Kalimantan, out-of-control forest fires have burned continuously since 1983, destroying millions of acres. These fires are sometimes set deliberately by farmers or loggers clearing small plots, but they are fueled by underground coal deposits, creating searing temperatures that roast the subsoil.

Borneo is also incredibly rich in minerals, including gold, coal, copper, platinum, and diamonds. There is a significant amount of petroleum on the east coast near Tarakan and Balikpapan and on the west coast near Miri (Sarawak) and Seria (Brunei). This wealth of natural resources is a source of economic strength for Brunei and eastern Malaysia, and a source of potential disintegration for Indonesia, as the outer islands seek greater autonomy from overcrowded and proportionately resource-poor JAVA.

Most of the population clusters along Borneo's rivers, as the coasts are too swampy and the interior too rugged. The indigenous people, known collectively as Dayaks, are divided into numerous tribes and live in various degrees of contact with other, nonindigenous peoples. Some were known as recently as the 1970s to practice ritual headhunting, but the practice has officially ceased.

Malayan people have had settlements and kingdoms on Borneo from about the 13th century, roughly the same time as the arrival of the third main group who populate Borneo, the Chinese, who dominated trade in the region for centuries. Dutch and British trading companies vied for dominance in the 18th and 19th centuries, with the Dutch ultimately controlling the southern three-fourths of the island, and the British controlling the north, including the sultanate of Brunei (a protectorate from 1888), the territory of the "White Rajah," James Brooke (Sarawak), and the world's last sovereign corporate-run state, British North Borneo (Sabah, governed until 1946 by the British North Borneo Provisional Association, Ltd.).

Rubber plantations were established by the British and the Dutch, but it was palm oil that became the backbone of colonial export, used to produce things like margarine and soap. Dutch Borneo became part of the independent Republic of Indonesia in 1949, while Sabah and Sarawak joined with Malaya to form Malaysia in 1957. Brunei remained a protected British state until 1984. Malays now form a larger percentage of the population on account of the exodus of large

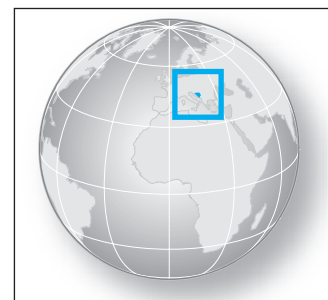
numbers of Chinese from both Malaysia and Indonesia in the face of growing xenophobia and Islamicism.

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## Bosnia and Herzegovina

**Map Page** 1133 **Area** 19,940 square mi (51,129 square km) **Population** 3,989,018 **Capital** Sarajevo **Highest Point** Maglic 7,826 ft (2,386 m) **Lowest Point** 0 m **GDP per capita** \$1,900 **Primary Natural Resources** coal, iron, bauxite, zinc, hydropower.



**BOSNIA AND HERZEGOVINA** was one of the component states of the former federation of Yugoslavia until it declared its independence in March 1992. Its ethnic and religious makeup had become so intertwined under the forced egalitarianism of Josip Tito that divisions and tensions between the country's three major groups—Bosnians, Serbs, and Croats—immediately turned to violence, as each nationality sought to carve out a portion of the country's territory for themselves.

The ensuing conflict caused the deaths of somewhere between 60,000 and 200,000 people and displaced about half the population. Since the peace agreements made in Dayton, Ohio, in December 1995, the country has been partitioned into two federated units, the Federation of Bosnia and Herzegovina and the Republika Srpska (Bosnian Serb Republic). Foreign troops sent in by the NORTH ATLANTIC TREATY ORGANIZATION (NATO) and by RUSSIA keep an uneasy balance, while the country's overall administrative affairs are overseen by a EUROPEAN UNION high commissioner.

Bosnia and Herzegovina occupies a mountainous central zone of the Balkan Peninsula, surrounded on all sides by other former members of Yugoslavia: CROATIA



to the north and west, and SERBIA AND MONTENEGRO to the west and south. The country has a tiny outlet to the ADRIATIC SEA, 18 mi or 29 km, wedged between portions of the long Croatian (Dalmatian) coast.

Although some of its rivers flow westward into the Adriatic, notably the Neretva, most Bosnian rivers flow east and north from the watershed of the Dinaric Alps into the Danube basin. These include the Sava, which forms the northern border with Croatia, its tributary the Drina, which forms part of the eastern border with Serbia, and other tributaries of the Sava, the Vrbas, and the Bosna, which gives the country its name. The other half of the country's name, Herzegovina, comes from an ancient feudal division of the region, this part being held by a duke (*herzeg* is a Slavic corruption of the German word for "duke," *herzog*).

Bosnia is much larger than Herzegovina, and although the population is mostly the same, the landscape is different. Herzegovina tends to be drier, rockier, with a Mediterranean climate, versus the more continental climate of the Bosnian interior. Sarajevo, the capital, is roughly in the center of the country, on the Bosna River. Other cities include Banja Luka, Tuzla, Bihac, and Mostar, the capital of Herzegovina. The only area of relative flatness are the plains along the Sava river valley in the far north.

## OTTOMAN EMPIRE

Ever since it was settled by Slavic tribes in the 7th century, the region has been dominated and contested by its more powerful neighbors, the Hungarians, the Croats, and the Serbs, with the exception of an independent Bosnian kingdom in the 14th and 15th centuries. The entire Balkan peninsula was incorporated into the empire of the Ottoman Turks dating from the 15th century, but unlike many of its neighbors, a large number of the Bosnian Slavs converted to ISLAM, for reasons ranging from genuine religious conviction to tax breaks and political advancement.

Today's Bosnians are descendants of these people, and differ from their Croat and Serb conationalists mostly in terms of religious affiliation, despite the fact that most Bosnians consider themselves only minimally religious. The Serb and Croat languages are nearly the same, but Serbians use the alphabet of their Orthodox faith, while Croat Catholics use the Latin alphabet. Even after the Dayton Agreement of 1995, the populations have continued to separate along ethnic lines, whereas twenty years ago, ethnic intermarriages were more common than not, almost one in three. The Federation of Bosnia and Herzegovina, primarily popu-

lated by Croats and Bosnians, and the Republika Srpska, populated by ethnic Serbs, are both oddly shaped—the latter (with roughly 50 percent of the land) wraps around the former—and include several ENCLAVES within each other, such as the internationally supervised district Brcko.

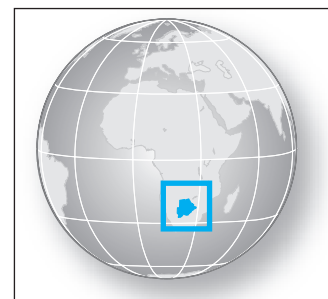
The wars of the 1990s and subsequent mass emigration has destroyed most of Bosnia's economy and left nearly 45 percent of the population unemployed. Even before the breakup of Yugoslavia and ethnic strife, Bosnia and Herzegovina was (along with Macedonia) the poorest region of the federation. Its economy had been focused not on food production, but chiefly on machinery and military supplies for the rest of Yugoslavia. Bosnia has a good supply of natural resources, including coal, iron, copper, and timber, which could form the core of a revived national economy.

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## Botswana

**Map Page** 1116 **Area** 231,803 square mi (600,370 square km) **Population** 1,573,267 **Capital** Gaborone **Highest Point** 4,890 ft (1,491 m) **Lowest Point** 1,682 ft (513 m) **GDP per capita** \$8,800 **Primary Natural Resources** diamonds, copper, silver.



BOTSWANA IS a LANDLOCKED country in southern Africa, approximately 310 mi (500 km) from the nearest coastline to the southwest. Although two-thirds of Botswana is within the tropics, the landscape is dominated by the KALAHARI DESERT (after the Setswana name *Kgalagadi*), a sand-filled BASIN averaging 3,607 ft (1,100 m) above sea level.

Botswana is bordered by ZAMBIA and ZIMBABWE to the northeast, NAMIBIA to the north and west, and

SOUTH AFRICA to the south and southeast. At Kazungula, four countries—Botswana, Zimbabwe, Zambia and Namibia—meet at a single point midstream in the Zambezi River in the extreme northeast. If it were not for an interesting strip of land in the north, the Caprivi Strip, Botswana might also have a border with ANGOLA. The Caprivi is a narrow strip of land in the far northeast of Namibia that is about 250 mi (400 km) long and forms the Namibian part of the border with Botswana. Germany exchanged the area (together with Helgoland) with the UNITED KINGDOM for Zanzibar in 1890. It was named after the German chancellor of the time, Graf von Caprivi, who signed the contract with the British.

### BOTSWANA RIVERS

The Chobe River runs along part of Botswana's northern boundary; the Nossob River at the southwestern boundary; the Molopo River along the southern boundary; and the Marico, Limpopo and Shashe rivers at its eastern boundaries. Like the Okavango and Zambezi rivers, the Chobe's course is affected by fault lines, which are extensions of East Africa's Great Rift Valley. Taken together, these three rivers carry more water than all other rivers in southern Africa combined. Except for the Okavango and Chobe areas in the north, the country has little permanent surface water.

The eastern hardveld (hard-surfaced grazing area), where 80 percent of the country's population lives and where its three largest urban centers are situated, is a wide strip of land running from the north at Ramokgwebane to the south at Ramatlabama. It has a more varied relief and geology with inselbergs (outcrops of resistant rock) and koppies (rocks that have been weathered into blocks) dotting the landscape. The southeastern hardveld has a slightly higher and more reliable rainfall than the rest of the country, and the natural fertility and agricultural potential of the soils, while still low, are greater than in the Kalahari sandveld (sand-surfaced grazing area).

### THE KALAHARI

The Kalahari Desert stretches west of the eastern hardveld, covering 84 percent of the country. The word *desert*, however, is a misnomer. Most of the Kalahari is covered with vegetation, including stunted thorn and scrub bush, trees and grasslands. The largely unchanging flat terrain is occasionally interrupted by gently descending valleys, sand dunes, isolated hills in the extreme northwest, and large numbers of pans that fill with water during the rainy season. These pans are of

great importance to wildlife, which obtain valuable nutrients from the salts and the grasses of the pans.

In the northwest, the Okavango River flows in from the highlands of Angola and soaks into the sands, forming a 5,791 square mi (15,000 square km) network of water channels, lagoons, swamps and islands. The Okavango is the largest inland DELTA system in the world, just slightly smaller than ISRAEL in size.

Although Botswana has no mountain ranges to speak of, the landscape is occasionally punctuated by low hills, especially along the southeastern boundary and in the far northwest.

### HISTORY

Formerly the British protectorate of Bechuanaland, Botswana adopted its new name upon independence in 1966. San (Bushmen) were the aboriginal inhabitants of what is now Botswana. Beginning in the 1820s, the region was part of the expansion of the Zulu and their offshoot, the Ndebele.

In the late 19th century, Boers (Afrikaners) from neighboring Transvaal spread into the region as gold was discovered. With the Boers continuing to encroach on native lands during the 1870s and 1880s and German colonial expansion pressing into South-West Africa (Namibia), the British were forced to reexamine their policies and established Bechuanaland as a protectorate in 1885. The southern part of the area was incorporated into Cape Colony in 1895, where a resident commissioner administered it until 1961. Although Bechuanaland had no nationalist movement, Britain granted it internal self-government in 1965 and full independence as Botswana on September 30, 1966.

Agriculture still provides a livelihood for more than 80 percent of the population but supplies only about 50 percent of food needs and accounts for only 3 percent of the country's gross domestic product (GDP). The country's water shortage and lack of sufficient irrigation facilities has severely hampered agriculture development, and only a small percentage of the land is under cultivation. Where there is sufficient water, corn, sorghum, millet, and beans are the principal subsistence crops, and cotton, peanuts, and sunflowers are the main cash crops. Cattle raising and mining dominate the economy.

At the time of independence, the only known minerals were manganese and some gold and asbestos. Since that time, large deposits of nickel and copper have been found, as well as salt and soda ash. Vast coal deposits are also being worked, and antimony and sulfur are known to exist. Botswana's three diamond

mines collectively make up one of the largest diamond reserves in the world. The stones are mined by the government and a South African mining concern, providing a strong link between Botswana's well-being and South Africa. Deposits of plutonium and platinum are also known to exist, but are as yet undeveloped.

Although Botswana's mineral wealth has made it one of the wealthiest nations of southern Africa, high unemployment remains a problem. Development of the tourist industry has been growing, based partly on the country's game reserves. Because of its landlocked position, Botswana remains heavily dependent on South Africa for the provision of port facilities.

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## boundaries, natural

GOVERNMENTS USE physical features as boundaries of political units: boundaries of countries, states, counties, cities, and so forth. (Not all political boundaries follow natural features. A boundary can be geometric, meaning it is composed of straight-line segments and arcs. There is a cultural type of boundary, as well. This boundary usually separates different ethnic groupings. There are also historical boundaries, which are natural, geometric, and cultural relicts of former political entities.) A natural feature, such as a river or mountain range, is a logical choice, as it is visible and tends to interfere with human movement and interaction. Natural features as political boundaries have advantages and disadvantages for various reasons that we will examine in the next section.

A second type of natural boundary—the boundary of a natural region—separates areas with certain dis-

tinctive types of landforms, climates, ecosystems, and so on. Geographers and other scholars often study landscapes within the confines of natural regions, so their boundaries are important. In the early 20th century, geographers and political ideologists merged the boundary of the natural region with the political theory of the organic state. The idea of an organic state with “natural” boundaries influenced Adolf Hitler's dictatorship of GERMANY.

### BOUNDARY OF A POLITICAL UNIT

When a political boundary conforms to some feature of the physical landscape—a stream, sea, mountain, desert, watershed, lake, marsh, and so forth—it is a natural boundary. Natural features have dimensions of length and breadth, whereas political boundaries are lines of separation. Consequently, two countries that share a natural boundary must agree on a method of marking a boundary line.

Across open land, such as along the crest of a mountain range, a mere line of poles, stones, or cement markers usually suffices. Buoys mark the boundary line if it passes along or across a large lake. Small lakes and narrow rivers may not have any clear demarcation, unless the boundary follows the water's edge. Boundary lines that use physical features are often difficult to survey. Several boundary commissions may be required to work at the setting up boundaries, employing detailed surveying and mapping information, before the involved states are satisfied.

### FRONTIER BOUNDARIES

Frontiers often function as natural boundaries. Frontiers are vast unsettled or underpopulated areas that separate and protect countries from each other. The inhospitable nature of frontiers impedes governmental control. Examples of frontiers are expansive deserts, marshes, oceans, frigid lands, dense forests, and rugged mountains. The spread of control from a country's political core area into a frontier gradually eliminates its boundary function.

CHILE is an example of a country that developed while surrounded by frontiers. Chile's political core was in Santiago Valley; the Atacama Desert lay to the north, mountainous ANDES to the east, frigid land to the south, and the PACIFIC OCEAN to the west. From Santiago Valley, the government extended its hegemony into the northern and southern frontiers. The Andes Mountains are a remaining frontier, as they still function as a natural boundary between Chile and ARGENTINA due to their awesome physical presence.

Historically, countries chose natural boundaries for their defensibility against attack from their neighbors. Modern military technology has reduced the defensive function of mountains today. The only exceptions tend to be the more rugged mountainous areas, where military advantage shifts toward controlling summits and key passes that are more defensible. The HIMALAYAS between INDIA and CHINA and the aforementioned Andes between Chile and Argentina are outstanding examples of defensible mountain boundaries.

Regardless of the decline in defensibility of natural boundaries, they remain part of the international political map. In many instances, historical and legal precedence preserve their usage. In other cases, such boundaries are still valuable for their barrier effect: They reduce the potential amount of friction brought on by past hostilities, as well as smuggling or illegal immigration.

### RIVERS AND LAKES AS BOUNDARIES

Rivers play a dual and contradictory role in the political state. Since the earliest civilizations, some rivers have united people more than they separated them. In early Mesopotamia, the Tigris and Euphrates rivers were highways of internal trade, commerce, and communication. Ease of transportation was crucial when riverine states in this region were in the process of formation, for this, in no small degree influences the extent of the political domain. The same was also true of the NILE in early EGYPT. The RHINE (in Europe), and the MISSISSIPPI (in the UNITED STATES), IRRAWADDY (in MYANMAR), Menam Chao Phraya (in THAILAND), Mekong (in VIETNAM and CAMBODIA), and Hwang Ho (in CHINA) play key roles as national unifiers today.

About one-fifth of the world's political boundaries are rivers. The actual boundary lines of rivers follow along either a bank or the mid-channel of a stream. Most river boundaries are of the mid-channel type in order to assure shared usage by adjoining political units. Lakes, for the same reason, tend to have divisional boundaries. The Canada-U.S. boundary divides the Great Lakes and the CALIFORNIA-NEVADA boundary does the same for Lake Tahoe. The CASPIAN SEA (actually a lake) in Central Asia, Lake VICTORIA in Africa, and the Bodensee (Lake Constance) in the ALPS are prominent international lakes.

Rivers in particular do not make perfect boundaries. They give the illusion of permanence on a map—a trait valued by boundary makers—but stream courses do change. For instance, the Mississippi, which for most of its length is a U.S. interstate boundary line,

has varied its course frequently, leaving parts of the left bank on the right side of the line and vice versa.

The international wanderings of the RIO GRANDE have made the problem of unstable river courses famous. An 1853 survey drew the boundary between the U.S. state of TEXAS and MEXICO down the middle of the Rio Grande. The first of a series of disputes came in the wake of floods in 1864, which caused a change in the river's course that left a chunk of 630 acres (about 1 square mi or 2.6 square km) of land north of the river. Several other wanderings resulted in losses or gains of land for both countries in the ensuing years. As the region became more populated, control of the boundary was more difficult.

In 1884, the two countries agreed that the boundary should follow the abandoned river channel whenever the river changed course. This meant that the area transferred from one bank to the other would remain under the sovereignty of the original state. However, this policy diminished the function of the river as a boundary. In 1905, in order to protect the integrity of the river as the boundary, the governments agreed to exchange land cutoff by the river, but only if the land area or the number of people living there was sufficiently large. Otherwise, the river channel would remain the boundary. A permanent commission was also set up to determine exchanges.

In the 1960s, the two governments finally stabilized the channel with concrete. Land claim problems along the border are rare today. The stabilization of the rivers like the Rio Grande is exceptional. Around the world, meandering rivers create potential boundary problems such as the Rio Grande did. Other disputes evolve around repositioning boundaries so that rivers become boundaries. The list below contains examples of rivers and lakes that are the bases of recent boundary disputes.

Amazon and Marañon rivers (ECUADOR and PERU)  
 Amur River (China and RUSSIA)  
 Atrak River (KYRGYZSTAN and TAJIKISTAN)  
 Belesa-Mareb-Setit Rivers (ERITREA and ETHIOPIA)  
 Caspian Sea (AZERBAIJAN, IRAN, KAZAKHSTAN, Russia, and TURKMENISTAN)  
 Congo/Zaire River (Democratic Republic of the CONGO and Republic of the Congo)  
 Essequibo River (GUYANA and VENEZUELA)  
 Ganges-Brahmaputra-Meghna rivers (India and China)  
 La Plata River (BRAZIL and URUGUAY, and Brazil and PARAGUAY)



Lake Chad (CAMEROON, CHAD, NIGER, and NIGERIA)  
 Lake Malawi (MALAWI and TANZANIA)  
 Lake Tanganyika (Democratic Republic of the  
 Congo, ZAMBIA, and Tanzania)  
 Linyanti River (BOTSWANA and NAMIBIA)  
 Maroni River (SURINAME and FRENCH GUIANA)  
 Mekong River (LAOS and Thailand)  
 New River (Guyana and Suriname)  
 Orange River (Namibia and SOUTH AFRICA)  
 Sara and Una rivers (BOSNIA-HERZEGOVINA and  
 SERBIA, and HUNGARY and SLOVAKIA)

### MOUNTAINS AS BOUNDARIES

Like rivers, mountainous areas may bring together a population, as in the northern Andes (COLOMBIA, Venezuela, Peru, and Ecuador), where heat and humidity drive people to the uplands. As mentioned earlier, historically, governments have held certain mountainous borders in high esteem, because as barriers, they defend a country by holding back or at least slowing down the enemy because of rugged terrain. Such borders are high, rugged, snow-covered, and glaciated and therefore, natural barriers to movement and communication.

Mountains are not ideal places to demarcate boundaries. Surveys may define the boundary along the highest crests (summits), the watershed (or divide), or points along the base of slopes. Additionally, boundary commissions have drawn many such lines after settlement of a mountainous region has already taken place, thereby separating people who share the same language or popular loyalties. A famous example of boundary superimposition happened after World War I. A postwar boundary commission had the task of carving out new countries from a defunct German-speaking Austro-Hungarian Empire. The commissioners drew the new southern border of AUSTRIA assiduously along the high mountain crest of the ALPS.

However, the line divided German speakers in the Alps's Tyrol region into two separate provinces. North Tyrol became part of Austria and South Tyrol part of ITALY. A similar problem of ethnic truncation arose in the Carpathian Mountains between POLAND and CZECHOSLOVAKIA. To the consternation of the people affected, the boundary commissioners did not rectify either problem; they claimed that the coincidence of high mountain crests with the parting of waters and the defensibility of the crests made perfect borders.

Disputes over mountain boundaries can lead countries to the brink of war. For instance, Argentina and Chile prepared for war in the late 19th century, as both

countries were dissatisfied with the Andean boundary they shared. At first glance, the Andes Mountains form what seems to be an ideal natural boundary separating the two countries. Unfortunately, a line joining the highest summits of the mountains does not always divide the watersheds. Particularly in the southern part of the boundary, where glaciers in Chile have eroded back the high ends of valleys to a point where they were well to the east of the line connecting the highest summits. Argentines argued that the highest summit line should cut across such valleys, meaning that eastern (high) ends of the valleys should belong to Argentina. Chileans saw it differently. They argued that the line should follow the drainage divide, meaning the boundary should loop around the high ends of the valleys, not pass from peak to peak straight across the valleys. Therefore, Chileans reasoned that the valleys should belong to Chile in their entirety. Ultimately the two countries agreed to ask the Queen of England to settle the dispute. The two countries agreed to a resolution in 1902. In gratitude for averting the war, the peoples of the two countries built a 26-foot-tall bronze Christ of the Andes statue in Uspallata Pass, the main route through the mountains between Buenos Aires and central Chile.

### OCEANS AS BOUNDARIES

Improved navigation of the seas brought about a concern for the legal status of the oceans and the ownership of marine resources in the 1600s. In 1672, the British claimed marginal waters as far as a cannon could hurl projectiles. Such a range was about 3 nautical mi (5.6 km). A judge of the Supreme Court of Holland added international credence to the distance in 1703, when he ruled that the same distance should be the legal limit of the territorial sea of all coastal countries.

The 3-mile limit remained the standard for most nations and the League of Nations formally accepted it in 1930. After World War II, as states turned increasingly to the seas for their resources as well as their transport and strategic value, international acceptance of the 3-mile limit began to unravel. A series of postwar treaties led to the 1982 United Nations Convention of the Law of the Sea (or Law of the Sea Treaty). Almost all the nations of the world have signed the 1982 convention. Nations view the Law of the Sea Treaty as generally reflecting customary international law, even by countries that have not signed it. The important points of the agreement can be summarized as follows:

*Territorial sea.* A coastal state's territorial sea can extend to 12 nautical mi (22 kilometers) from the shoreline. The state has full sovereignty rights to the air space above and to all resources in the sea, including those in the underlying seabed and subsoil. The coastal state controls access to the territorial sea by foreign nations. (Some nations, including Peru, Ecuador, SOMALIA, and the PHILIPPINES still claim territorial seas to 200 nautical mi despite the treaty.)

*Contiguous zone.* A coastal state may extend its legal right to control foreign vessels in a zone that is contiguous to its territorial sea. This zone can be up to 12 nautical mi (22 km) wide. As in the territorial sea, the country's customs and military agencies, as part of their regular duties, can authorize law enforcement personnel to board foreign vessels to search for and seize contraband (for example, illegal drugs or terrorists) or evidence of other alleged illegal activities.

*Exclusive economic zone (EEZ).* This zone normally extends out from the territorial sea to 200 nautical mi (370 km). However, the zone can extend as far as 350 nautical mi (649 km) to the edge of the continental shelf, if the shelf extends beyond 200 nautical mi. Within its EEZ, the coastal nation has sovereign rights over mineral resources, fishing, and environmental protection. The nation may exercise control over access to the zone for scientific research. It also has control over exploitation of resources, including the mining of minerals, drilling of oil, and the use of water, currents, and winds for the country's production of energy.

The United States has the world's largest EEZ, not because of its coastlines around the contiguous states, but because of the vast additional EEZ area contributed by ALASKA, HAWAII, PUERTO RICO, the U.S. Virgin Islands, and the various U.S. Pacific protectorates and islands, including American Samoa and Guam. As a result, the U.S. EEZ contains many of the world's most productive fisheries, and probably a large share of the mineral wealth of the oceans.

The cooperation of nations to define boundaries in oceans is a necessary and positive step toward avoiding conflicts involving offshore territory and marine resources. Nevertheless, sovereignty disputes over overlapping boundaries of territorial seas and EEZs are increasing political tensions in the world. Most disputes involve overlapping EEZs that surround tiny island nations located on a continental shelf, as such nations can control an EEZ greater than the size of Minnesota. The seas off the coasts of East and Southeast Asia provide many examples of EEZ disputes.

## BOUNDARY OF THE NATURAL REGION

R. Hartshorne (1939) describes how, during the late eighteenth and early nineteenth centuries, European geographers became interested in defining geography as a separate science and not a mere handmaiden of history and government. "In place of the definite areal units of states," Hartshorne writes, "sharply defined by political boundaries, the new geography required equally definite 'natural' units, somehow defined in nature."

Geographers produced some interesting studies and maps of natural regions bounded by natural features during the period. Hartshorne makes clear that geographers abandoned the notion that geography was solely the study of natural regions, although he argues that this movement was the genesis of modern physical geography.

The concept of natural regions remains part of the discipline of physical geography. In biogeography, natural boundaries delineate major BIOMES: forests, grasslands, deserts, tundra, and marine. In geomorphology, natural boundaries define areas of various types of landforms, including expansive plains, plateaus, and mountainous areas. Natural boundaries define the regional limits of numerous other environmental phenomena; they separate climates, vegetation types, soils, geological formations, environmental classifications, and so on.

Unlike boundaries of a political unit, boundaries of a natural region do not have surveyors' monuments to alert us to their locations. It usually takes an informed observer to identify such boundaries. In addition to geographers, scholars ranging from anthropologists to zoologists, concern themselves with identifying natural boundaries, as they also study plant and wildlife within the confines of natural regions.

A boundary of a natural region is actually a transitional zone that is sometimes difficult to define. For instance, the topographic boundary between the Great Plains and the Rocky Mountains in North America is a gradual change from planar to mountainous terrain. This boundary is an example of a single-feature boundary, as it separates two classes of one element—landforms. Boundaries of multielement regions are more difficult to define, as each element's distribution fails to coincide perfectly with that of the other elements. For example, broadleaf deciduous trees and coniferous trees do not coincide well in a mixed forest biome. As a result, the biome's boundary is a compromise that depends upon the decision of the scientists who are defining the region.

## ORGANIC STATE THEORY

In the late 19th and early 20th centuries, some political geographers treated the state (meaning a country) as if it were a natural region. Friedrich Ratzel was an influential German political geographer who developed this organic state theory. He used an analogy to compare the state with an organism. According to his analogy, a state is a living thing. Like plants and people, it needs living space and resources and constantly competes against other states for them. Hence, state boundaries are natural or organic entities that must grow outward for the state to survive. Strong governments, according to this view, would seek to adjust their natural boundaries by conquest or annexation. Ratzel emphasized that his description was an analogy, not a basis for state policy.

A few scholars of the time—notably the Swedish political scientist Rudolf Kjellén—took Ratzel’s analogy literally and insisted flatly that the interdependence of people and land creates an organic state. This so-called theory, as Kjellén saw it, gave countries a rationale to use force to expand their borders to meet their territorial needs. These ideas later expanded in the 1920s by the German Karl Haushofer. The German dictator Adolf Hitler adopted Haushofer’s organic state theory wholeheartedly. Hitler called his organic state the Fatherland. The Fatherland, according to Hitler, was composed of Germans, who were an advanced “race” of people whose superiority came from an innate spiritual bond with the land. Before the outbreak of World War II, heavy concentrations of Germans lived in countries adjoining GERMANY. Hitler believed that unifying the superior German race would strengthen the Fatherland, which would then continue to grow its boundaries through armed aggression until it encompassed Europe.

Hitler’s persuasive speeches and Nazi propagandists’ deceptive maps seduced German citizens into thinking that expanding Germany’s borders to include other Germans living in adjoining countries was the right thing to do. Hitler began expanding German territory to its “natural” limits by invading Austria in 1934; this was a country composed entirely of German speakers.

Under the same trumped up pretext, Hitler invaded the Rhineland in France (in 1935), annexed part of Czechoslovakia (1938), and invaded western Poland (1939). All these areas had large German populations. The invasion of Poland precipitated World War II, as most countries of Europe knew Hitler’s aggression would not stop in German-populated areas. Italy and

JAPAN subsequently used variations of the facile organic state theory to justify their aggressions as well.)

Geographers are not to blame for World War II; they discarded the organic state theory into the dustbin of bad ideas long before the war began. Rather, the blame goes to self-serving demagogues who resurrected, perverted, and used the theory as a rationale for boundary aggression and war. Lamentably, in a culturally diverse modern world, misguided claims to natural-cultural boundaries are always a danger. For example, Bosnia and Herzegovina’s leaders, whose population is composed mainly of Serbs, used ideas akin to the organic state theory to justify “ethnic cleansing” and forced emigration of non-Serbian minorities in the 1990s. Only military action by U.S. and North Atlantic Treaty Organization forces was able to stop government-sponsored terror in that country.

A lesson from Hitler’s Germany and Bosnia and Herzegovina’s “ethnic cleansing” is that country boundaries are not natural and therefore limited to a particular nation or group of people: Mountains, rivers, lakes, oceans, and cultural lines only become boundaries after people decide that they should be. Indeed, countries have a choice of using fairness and compromise over prejudice and war in dealing with so-called natural boundary disputes.

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## boundaries, political

**POLITICAL BOUNDARIES** are frequently defined as borders constructed and imposed on or around a geographic territory in order to distinguish between areas of governance or types (strategies) of political control. They function both as a tool for managing a group of

peoples and as a way of minimizing conflict and organizing efficient political units. Political boundaries can divide not only territory but cultures, languages, ethnicities, and natural resources. In doing so, they can provide people with a sense of security and belonging or, alternatively, with a sense of exclusion.

Political boundaries appear in multiple, differing forms and operate on a variety of scales. The most commonly pictured political boundary is one that takes the form of a man-made physical structure, for example, a barbed-wire fence or a checkpoint. Major international political boundaries frequently take this particular form, particularly political boundaries between uneasy, unstable political neighbors. These political boundaries can often become particularly militarized, as evidenced by the border between the UNITED STATES and MEXICO, although certain international borders lack any means of physical monitoring (certain sections of the border between the United States and CANADA, for example).

Other political boundaries may follow natural, physical boundaries. The edge of a lake or the path of a riverbed can provide a naturally occurring political boundary. Finally, political boundaries can also be visible only on a map and not at all evident to the naked eye. This type of particular border can be found between counties within individual states in the United States, for example. This does not make the border less effective in dividing a particular region or area into political units, but instead suggests that there is no risk to the state in allowing individuals to freely travel between such political units.

Political boundaries occur at a variety of different scales, from global (boundaries between nation-states) to local (boundaries between towns, voting districts, and other municipally based divisions). Such boundaries can also occur at an international level, “above” the nation-state. International boundaries are becoming increasingly important as international human rights takes on an increasingly visible role in the international arena. Such boundaries can include those between organizations providing certain measures of security and countries that are not a part of such a group and not protected by their resources. At all levels, however, political boundaries not only demarcate political control, but determine distribution of resources, from international protection to other, more local benefits, demarcate areas of military control, divide economic markets, and create areas of legal rule.

As a general rule, political boundaries are never static but rather are constantly subject to shifts and

changes. Traditionally, boundaries between countries have received the most attention, and been the subject of the most intense disputes. Such disputes over political boundaries arise over questions involving how to determine where boundaries are located, how such boundaries are to be interpreted, and who should control areas within the boundaries at issue. Efforts to change international political boundaries between nations require consent of the relevant nations; however such borders are more often the site of attempts to forcibly change (or ignore) political boundaries. When such consent is not forthcoming, political boundaries frequently become the site of conflict.

Where political boundaries divide (or combine) ethnic groups, such boundaries can feed ethnic conflict, as a group of peoples is forced apart or merged together. Political boundaries also raise significant issues surrounding immigrant and refugee flows, as regulations and restrictions over admitting or excluding individuals from a particular nation place a country’s political boundary at the center of the debate.

Within the United States, disputes over political boundaries frequently involve issues of race and class, as reflected in the numerous legal disputes over election districts and accusations of gerrymandering. The recent 2003 case of *Georgia v. Ashcroft* dealt with the issue of redistricting, overruling a lower court decision that had determined that the redrawing of election districts in Georgia following the 2000 election was improper in its attempts to spread the black voting population among a greater number of districts in an effort to elect more Democrats into office. The Supreme Court held that lower courts reviewing redistricting cases should consider all relevant factors and not concentrate solely on the issue of whether or not minorities within existing districts are able to elect a minority candidate.

## POSTMODERN DEBATES

Current postmodern debates over political boundaries suggest that rather than bordered nation-states, we are heading toward a more borderless world, with fluid borders and more interdependence among nation-states. Nation-states in the modern world have suffered increasingly not only from external attacks on their political boundaries, but from internal attacks by self-defined political groups. Part of this transition into postmodernism is a shift in our understanding of political boundaries. Traditionally understood as defining the geographic territory of a sovereign, postmodern studies of boundaries speak of areas of jurisdiction,



many of which are no longer place-bound. These theories try to reconcile changing conceptions of political boundaries and nation-states with the idea that for many people, citizenship and identity remains very place-bound and nation-specific.

Contemporary debates also acknowledge the realization that the effects of communities bounded by political boundaries necessarily impact others on the other side of the political boundaries, fueling the debate over the utility and danger of political boundaries. Countries are increasingly conscious of the impact that policy decisions made within their political boundaries will have on those located outside of a country's political boundaries.

Beyond impacting purely theoretical debates, changes in the concepts of political boundaries will increase the organization, use, and influence of structures and organizations, particularly at the global level. The increasing transparency or blurring of political boundaries has led to increased importance being placed on international organizations. This is particularly true with respect to work being done in the areas of human rights and environmental policy, where transnational organizations are one of the key forces leading both global movements.

Other research into issues of the blurring of political boundaries has focused on the impact of political boundaries on the tourism industry. Political boundaries necessarily present an impediment to tourism in certain respects, imposing passport and visa requirements, and in some instances preventing entry for tourists altogether. Countries have in some instances, however, worked together to lessen the administrative costs of maintaining a border and processing tourists, sharing the infrastructure costs of borders.

The increase in immigrant communities is changing the concept of the nation and decreasing the significance of political boundaries. As immigrants form communities, social ties, and networks within new countries, and as they develop resources (economic, political, and social), they are increasingly developing organizations and institutions that operate above political boundaries. Further, in dealing with immigration issues, individual nation-states are reaching across political boundaries, making policy decisions and taking actions that violate the traditional political boundary of the individual nation-state. This can happen, for example, by countries enacting policies that allow for immigration of certain individuals who might be criminalized under their home country's laws. Political scientists and others are just beginning to study the

possible impacts of this new trend of what is being referred to as immigrant-based transnationalism.

Political boundaries have become a source of debate with respect to new technologies and modes of communication as well, particularly issues involving cyberspace jurisdiction and control. As Dan L. Burk notes, "The primary challenge posed by international information exchange is essentially political and caused by the erosion of political boundaries. This increasing porosity of national boundaries has made it difficult for nations to exercise traditional aspects of sovereignty."

Cyberspace communities are forming that do not take the form of traditional communities, possess no political boundaries, and have no traditional forms of political control. Many unanswered questions remain surrounding how such communities should define their boundaries, and how they are to operate within and with respect to such boundaries.

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## Bouvet Island

BOUVET ISLAND, a territory of NORWAY, is known as one of the peri-Antarctic islands, small uninhabited rocks and volcanic islands that circle the frozen continent. It was discovered by Jean-Baptiste Charles Bouvet de Lozier, a lieutenant in the French East Indies Company, on New Year's Day, 1739, but not found again until nearly a century later. Located at one of the

most remote spots on the globe, it has rarely been visited and little is known about its landscape. It has been administered by Norway since 1928, which designated it a nature reserve in 1971. Norway also maintains an automated meteorological station.

The island is located about 1,800 mi (2,900 km) north of ANTARCTICA. The island is volcanic and forms the southern terminus of the submarine Mid-Atlantic Ridge. Three volcanic peaks rim an ice-filled plateau (the Wilhelm II Plateau), which is the collapsed center of an older volcano.

Two large glaciers descend from this plateau, sharply on the west, and more gradually on the east. Steep cliffs, up to 1,650 ft (500 m) high, encircle the island and add to its inaccessibility. Most of the island is covered with ice several hundred meters thick. Bouvet de Lozier had originally hoped to find a convenient provisioning spot for French trading vessels but was discouraged by the island's climate.

It was claimed by Britain in 1825 and renamed Liverpool Island. Whalers and seal hunters visited its waters, but this was never a huge industry since the island lies within the Antarctic convergence zone (unlike other islands of the South Atlantic or South Indian oceans) and is therefore trapped by sea ice for much of the year. Since the 1970s, there has been little human activity, with the exception of a mysterious nuclear bomb test to the northeast in 1979, which remains unclaimed (suspicions fell on South Africa).

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## Brazil

**Map Page** 1140 **Area** 3,286,488 square mi (8,511,965 square km) **Population** 184,101,109 **Capital** Brasilia **Highest Point** 9,888 ft (3,014 m) **Lowest Point** 0 m **GDP per capita** \$7,600 **Primary Natural Resources** bauxite, gold, iron ore, uranium, petroleum.



BRAZIL IS THE LARGEST and most populous country in South America. The country occupies almost half of the continent. Slightly smaller than the UNITED STATES, it is the fifth-largest country in the world. Brazil has become the leading economic power in South America, due to its vast natural resources, a large labor force, and impressive developments in industry and agriculture. At the same time, income distribution in the country is highly unequal.

The ATLANTIC OCEAN borders Brazil to the east. The country shares a border with every country in South America except for CHILE and ECUADOR. A majority of Brazil is tropical, as it is located between 5 degrees north and 33 degrees south latitude. A small percentage of the country is below the TROPIC OF CAPRICORN.

By the end of the 20th century, the population of Brazil had reached about 180 million. The population has grown extremely fast since 1950, with annual growth rates greater than 2.2 percent. Because of the recent and rapid population growth, Brazil possesses a young population, with two-thirds of the people under age 25. The population is unevenly distributed, as it concentrates along the coast. Coastal areas have a population density of about 12 inhabitants per square mile, while in the interior that figure is a mere 2 people per square mile. Brazil is also a highly urbanized country, with two-thirds of the population living in cities. Population growth has been accompanied by significant rural-to-urban migration.

The population of Brazil is a mixture of Native American, European, African, and Asian peoples. Brazil had no large Native American civilizations as in MEXICO or PERU. At the time of the arrival of Europeans in 1500, there were perhaps 1 million indigenous people in Brazil. These native inhabitants can be divided into two main categories: the Tupí-Guaraní and the Tapuya. In 1500, the Portuguese became the first Europeans to encounter Brazil, which became a Portuguese colony until 1822. In the 19th and 20th centuries, numerous European immigrants came to Brazil from countries such as PORTUGAL and ITALY. Brazil also possesses a large African population as a result of the slave trade. Brazil received more African slaves than any other New World colony. In 1888, Brazil became the last country in the Western Hemisphere to abolish slavery.

The Guyana Highlands in northern Brazil extend into the neighboring countries of VENEZUELA, GUYANA, SURINAME, and FRENCH GUIANA. The region is rugged and transportation is difficult. Many parts are still very inaccessible, and the Guyana Highlands are one of the

world's last natural and cultural preserves. The highest peak in the region is Mount Roraima, which reaches 9,432 ft (2,875 m). While the area is rich in mineral resources, few have been exploited until recently. Some parts of the northern highlands are now heavily mined for gold, diamonds, iron-ore, and bauxite. There are also many rapids and waterfalls in the Guyana Highlands, most of which drain into the AMAZON system.

The Amazon is the dominant river system in Brazil. The river is so large that it is often referred to as the "river-sea" in Portuguese. The Amazon River has a greater volume of water than any river, containing 14 times the volume of the MISSISSIPPI RIVER. The river's width varies from 1.9 to 8.8 mi (3 to 14 km), making it impossible to see from shore to shore at many points. The Amazon begins high in the ANDES mountains in Peru and flows eastward toward the Atlantic Ocean for some 4,000 mi (6,437 km). More than 1,000 tributaries join the river along the way. The Amazon and its tributaries provide more than 25,000 mi (40,233 km) of navigable routes. At 200 mi (322 km) across and 200 ft (61 m) deep, the mouth of the Amazon is so wide that it holds the Ilha de Marajó, an island the size of SWITZERLAND. Ocean-going ships can reach the city of Manaus, located 1,000 mi (1,609 km) inland.

## RAINFOREST

The BASIN around the Amazon River is the largest in the world. It drains some 3 million square miles in Brazil alone and covers more than one-third of the country's territory. The Amazon basin is an ecologically diverse region that includes RAINFORESTS and tropical GRASSLANDS. One-third of the world's rainforest is contained in the Amazon region. The Amazon rainforest possesses a great variety of plants and animals. However, exploitation by human beings has threatened the environment in the Amazon. From a 19th-century rubber boom to 20th-century gold rushes, Brazil has often attempted to exploit the region. The resultant increase in human settlement has led to the destruction of much of the Amazon rain forest.

The Brazilian Highlands, also called the Brazilian Plateau, make up the heart of the country, covering more than one-third of Brazil's territory. The Highlands stretch from the south near the borders with URUGUAY and PARAGUAY to the north near the Amazon River. This region of Brazil is mostly old, eroded landscape that averages 2,000 to 3,000 ft (607 to 914 m) in elevation. The Brazilian Highlands are similar geologically to the Guyana Highlands, with many rapids and waterfalls. The most famous waterfall in the region is



*The Statue of Christ the Redeemer, overlooking the city of Rio de Janeiro, Brazil, is one of the tallest statues in the world.*

Iguaçu Falls. The Iguaçu River consists of miles of rapids, which fall dramatically to join the Paraná River. The Brazilian Highlands can be divided into three subregions: the Great Escarpment, a large interior zone of sedimentary rocks, and the Mato Grosso Plateau.

Located along the Atlantic edge of the Brazilian Plateau is the Serra do Mar, or the Great Escarpment, which provides a barrier between the coast and the interior of the country. The Great Escarpment rises abruptly from the Atlantic Coastal Plain to heights up to 9,000 ft (2,743 m). Because of the presence of the Great Escarpment, few rivers flow from the interior to the coast, with the São Francisco being the major exception. The escarpment has historically served as an obstacle to human settlement in the interior of Brazil. The Atlantic side of the Great Escarpment receives heavy rainfall. The port city of Santos on the coast re-



ceives some 8 in (20 cm) of rain annually. In contrast, São Paulo receives only 50 in (127 cm) per year. Rainfall decreases moving westward. The escarpment and the interior to the west have rich mineral deposits. In the 17th century, colonial Brazil enjoyed a gold and diamond boom. By the 20th century, important industrial minerals such as titanium, manganese, chromium, and tungsten were mined.

The large interior region of the Highland consists of sedimentary rocks over the old crystalline base. In the north is the famous *sertão*, a desolate, eroded backland. Consisting of scrub forests, these backlands receive very irregular rainfall, leading to long droughts and flash floods. In the south is the Paraná Plateau, where deposits of volcanic lava created the famous fertile red soil important for the production of coffee and other agricultural products.

Brazilians have long seen the Mato Grosso Plateau as a frontier area of great potential. Brazil acted on this view by building the new national capital of Brasília there in the 1950s. This new capital in the interior of the country would serve as a symbol of modern Brazil. In later years, the plateau has been opened to mining. Also located in the Brazilian Plateau is the Pontanál, a large wetland drained by tributaries of the Paraguay River. This wetland is home to much biological diversity. However, it is severely threatened by human development.

The Atlantic Ocean has always been important for Brazil. Immigrants, traders, money, and ideas all flowed into the country across the ocean. Brazil's great natural resources flowed out via the Atlantic. The country's population has historically stayed close to the narrow Atlantic Coastal Plain. One 17th-century historian wrote that Brazilians "cling crab-like to the beaches." The coastal plain possesses a number of excellent bays such as Todos os Santos and Guanabara.

The Atlantic Coastal Plain was once covered with dense forest. Even before the arrival of Europeans in the 1500s, the native Tupí people practiced slash-and-burn agriculture that involved clearing much of the forest. The Portuguese continued to destroy much of the forest. Only about 10 percent of the original Atlantic forest remains. The region is home to many rare and endangered species that are found nowhere else in the world.

The plain is widest at the Reconcavo region near the city of Salvador da Bahia. It was here that Portuguese settlers implemented a large-scale system of sugar plantations. Using slaves, the Portuguese made Brazil into the world's leading sugar producer.

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## British East India

IT CAN BE ARGUED that Portuguese, Dutch, and French merchants exploited India; Britain remade the subcontinent. British East India grew from a series of coastal trading posts to encompass the part of the Indian subcontinent taken by the current states of INDIA, BANGLADESH, and PAKISTAN. The subcontinent's southern peninsula extends to the HIMALAYAS mountains that separate the subcontinent culturally and geographically from the colder CHINA and MONGOLIA and Asia proper. Bangladesh, India, and Pakistan cover 1.5 million square mi (3,885,820 square km) of land. The climate ranges from tropical monsoon in the south to temperate in the north. Geographical features include the Deccan Plateau, the Baluchistan Plateau, the INDUS and GANGES Plains, as well as mountains and deserts.

The Governor and Company of Merchants of London Trading into the East Indies received its charter from Queen Elizabeth on December 31, 1600. The first East India Company ship reached Surat in 1608, where the company established a factory in 1615. Along India's east and west coasts, English communities were settled in Madras (1639), Bombay (1668) and Calcutta (1698.) The company used alliances and treaties with hundreds of local princes to control more of India while also exploiting the East Indies. Mostly, it left the people to themselves, except when it exploited or mismanaged laborers.

In 1717, the company won exemption from customs duties in Bengal. In 1748, the British defeated the French, removing their last European rival. At the Battle of Plassey (1757), Robert Clive bested the nawab of Bengal and became ruler of India instead of its trading partner. The company mismanaged Bengal, alienating the people. Military expenses became almost overwhelming, so the British government implemented



Lord North's India Bill, the Regulating Act of 1773, which established a British governor-general, the first of whom was Warren Hastings. The company continued to collect revenues, negotiate agreements, and expand its territory. The British took territory they considered poorly ruled. Sometimes a remaining native ruler had a British adviser. Under the practice of lapse, British India acquired all states with no successor on the death of their rulers. British India absorbed Sambalpur (1849), Baghat (1850), Jhansi (1853), Nagpur (1854), and Awadh (1856). Annexation, taxation, and desperation provoked the Sepoy Mutiny of 1857–58.

The wars ended company rule as the British occupied the 750,000 square mi (1,942,481 square km) inherited from the East India Company. By 1900, 100,000 British ruled 250 million Indians. Under the Raj (1858–1954), Queen Victoria promised to work for the welfare of the native people.

The doctrine of lapse ended. The British recognized the princely states, roughly 562 of them with 40 percent of the territory and 20 to 25 percent of the population. In practice, outside British India, the states could not escape British political, cultural, and economic influence.

India received the English educational system, an expansion of its coal and iron mining, and plantations for tea, coffee, and cotton. Metal-plated roads and a hundreds of miles of railway linked the major cities and the coast. Telegraph lines stretched 4,000 miles. Agricultural and social reform occurred as well. Indians became increasingly Anglicized. They joined the civil service and published English-language as well as vernacular journals. Indians also became nationalistic in the 19th century. To ease conflicting Muslim and Hindu nationalisms in the late 19th century, the British wanted to partition Bengal into Muslim east and Hindu west.

British East India expanded by absorption of its neighbors. Border disputes with Burma in 1824, 1852, and 1885 resulted in Britain's taking of upper Burma into the Raj as India beyond the Ganges. Burma became a Crown Colony in 1937 and independent in 1948.

Punjab was a region of interest from the 1830s and eventually became part of India. Indian Ghurkas ruling Nepal fought a war with northwest India (1814–16). They conceded territory and Ghurka troops fought in the British and Indian armies. Bhutan and the East India Company had a treaty of cooperation from 1774. After a war in 1864, Britain had oversight of Bhutan's external affairs. The role was taken first by

British India (1910) then by independent India (1947). Bhutan became independent in 1949.

Overseas service under Great Britain command in World War I increased pressure for more Indian participation, with the Indians always a step ahead of what Britain would grant. Finally, after World War II, British India ended, replaced by independent India and Pakistan in 1947. The transition was violent, with perhaps 500,000 dead, and a migration of 11 million Hindus, Sikhs, and Muslims. And states such as Hyderabad that wanted independence had to choose either India or Pakistan. Hyderabad chose India, as did KASHMIR despite being predominantly Muslim.

Britain gave India its university system and its middle class and elite cultural artifacts such as clubs and gyms. Britain standardized grammar, gave away dictionaries, and provided the printing press, the Kalighat school of painting of the 19th century, and cricket as well as scotch and soda.

For the dams, roads, sanitation, and other infrastructure Britain gave India, in return it imposed laws requiring India to produce plantation crops. British restrictions on Indian manufactures kept the economy dependent. The shift from agriculture for internal consumption increased Indian risks of famine and death. By the 1880s, India took as much as 20 percent of British imports. By 1900, India paid Britain £10 million per year in interest and also paid salaries and pensions for the colonial administrators. India paid well for British improvements.

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## British Empire

IN THE 15th and 16th centuries, English trading ships were already sailing to JAPAN via Africa, INDIA, and CHINA, but there was no English sovereignty in these places. The term *empire* then designated the association between England, Scotland, IRELAND, and Wales.

During the 17th and 18th centuries, a network of territories stretching from America to Southeast Asia came under British control. The British Empire had been founded. In spite of the loss of the American colonies in 1783, the 19th century saw the rise of empire as British rule was extended to other regions. Over the next century, weakened by two world wars and changing global economics, Britain forfeited most of its possessions and granted independence to lands that had formed the cornerstone of British prosperity and identity for more than three hundred years.

### 17TH CENTURY

The first attempts at venturing abroad with a view to settlement were made in the 17th century by individuals interested in setting up trading initiatives. The first plantation of this type was established at Jamestown, VIRGINIA, in 1607, led by the Virginia Company of London, created in 1606. The company was dismantled in 1624 and Virginia subsequently became England's first royal colony. Government in the Chesapeake region developed along broadly English lines, with the creation of the office of governor, shires or counties, and parishes with local assemblies and magistrates.

New England was settled in 1620 by a small group of dissenting Protestants, the Puritans. The *Mayflower* reached America in 1620 and her passengers chose Plymouth as the site for the plantation of the settlement. The Massachusetts Bay area was colonized in 1630 by way of the Massachusetts Bay Company, established in 1629. By 1650, new American colonies had been created including, CONNECTICUT, NEW HAMPSHIRE, and RHODE ISLAND.

The mid-Atlantic coast and its HINTERLAND between the Chesapeake region and New England were massively settled from 1660 onward. Conquest of New Amsterdam, renamed New York after the conqueror and proprietor the Duke of York, occurred in 1664 and covered a huge expanse of middle territory. Quakers settled in NEW JERSEY in 1675 and proprietor William Penn founded PENNSYLVANIA in 1682. SOUTH CAROLINA was settled in 1670 and NORTH CAROLINA in 1712. In these colonies, the mode of governance gradually became one of self-rule as the century progressed.

English possessions in the Americas were simultaneously being added to by acquisitions and conquests in the Caribbean. By the 1620s, private investors and rich aristocrats had acquired royal patents. Saint Christopher (SAINT KITTS) was settled in 1624, BARBADOS in 1627, Nevis in 1628, Montserrat and Antigua in

1632. JAMAICA was annexed in 1655 following Oliver Cromwell's Western Design on Spanish Possessions. Demand for cheap labor for work on the plantations rose and indentured English servants flooded to the islands. The alternative source of manpower was slavery. Tobacco, cotton, and sugar were the main exports. Other islands were taken toward the end of the 17th century including SAINT VINCENT, SAINT LUCIA, Tobago, and GRENADA.

British government policy in this period was based on an intention to control trade. In the 1650s, Navigation Acts (initially introduced by Cromwell) ensured that only English ships could import to Britain or Ireland or other English colonies, that all exports from the colonies transit through England, and that preferential import duties be reserved for English sugar.

By the end of the century, the English Caribbean colonies had nevertheless managed to secure self-government. A wealthy planter ruling class had emerged and began to dominate the various assemblies and legislatures.

### HUB OF THE EMPIRE

Thus the "Atlantic system" came into being. The Caribbean colonies constituted the hub of the empire, and the American colonies and the Mother Country, the spokes.

On the other side of the ocean, there was little English interest in the western African coast. Various companies were set up there, flourished for a while, and were replaced by others or independent traders. Land was "leased" to the English by indigenous leaders, so to speak of colonization of western Africa in the 17th century would be premature. These outposts were to later become the British colonies of GAMBIA, SIERRA LEONE, and the Gold Coast.

Further afield in Asia, chartered companies were trading for spices, textiles, and exotic merchandise like Chinese ceramics. The English East India Company was one of these and obtained a royal charter in 1599. English trading posts were established in India (in Gujarat and on the eastern Coromandel Coast and later Bengal) with the local rulers' assent. There Englishmen, like traders of other nationalities, "settled" in small communities, notably in Surat and Madras. The English Crown acquired Bombay from the Portuguese in 1661 and as the years passed, white settlement increased around Bombay, Madras, and later Calcutta in Bengal (1690 onward).

These settlements took the shape of forts protected by small contingents of soldiers. In INDIA and Africa,

these settlements were administered by the Companies themselves with a view to protecting trade interests.

## 18TH CENTURY

At the end of the 17th century, English possessions in North America included New England, the Middle Colonies, Virginia, and the Carolinas. Britain acquired Acadia (Nova Scotia), Newfoundland, and Hudson Bay in 1713 thanks to the Treaty of Utrecht. In the south, GEORGIA was settled in 1733 by charter and became a royal colony in 1751. The PENNSYLVANIA frontiers expanded westward and southwestward. Britain had acquired new markets and exports rose significantly in the 1740s. After the Seven Years' War against France (1756–63), Britain made huge gains, including the Floridas and in the north, Quebec. In 1791, Quebec was split into two and Upper Canada became English speaking and Lower Canada became home to the conquered French.

Britain, though, was soon to lose the oldest and most significant part of its recently extended empire. After 1763, the British government made inroads into colony governance in order to reduce expenditure, shore up domestic finances (in a sorry state after the war), and consolidate imperial authority through taxation and strict regulation of trade. These measures worried local American elites used to autonomy.

Confrontations between the “Americans” and the British army began in 1775. The colonies declared their independence in 1776 after a year of fighting. The war lasted until 1783, when a peace treaty was signed. The UNITED STATES acquired territory stretching from the MISSISSIPPI RIVER to the southern shores of the Great Lakes. In terms of empire, Britain was left with British North America, namely the Canadas, Nova Scotia, the Hudson's Bay Company territory, and the Newfoundland fisheries.

The Caribbean, on the other hand, prospered in the 18th century in spite of periodic recession. After the Seven Years' War, the islands under British control were Jamaica, Antigua, Saint Kitts, Nevis, Montserrat, the BAHAMAS, the Virgin Islands, DOMINICA, Saint Vincent, Grenada, and Tobago. After the Napoleonic wars (1793–1815), Britain acquired Trinidad, Saint Lucia, and Demerara.

Britain had also gained prominence elsewhere in the 18th century. In 1744, hostilities at sea between the East India Company and the French were transferred to land in southeastern India as each country allied with contending Indian groups. The British (represented by the company) and the nawabs claimed vic-

tory in 1746. Ten years later, the company and the nawabs were themselves at war. Calcutta was taken but recovered in 1757. Thus, Bengal became a client state and later in 1765 a province under British government rule. Meanwhile, Surat was captured by the British in 1759.

The British government, though, did not actively participate in expanding the Empire in India other than by providing the company with troops. But India did become essential to national prosperity as exports increased. This in turn encouraged greater governmental commitment to conquest. A governor-general was appointed and exercised authority over all the company's territories and a supreme court was set up in Bengal in the early 1770s.

British territorial acquisition was also being consolidated in the south. James Cook's voyages to the Pacific (1768–79) increased British possessions with the discovery of HAWAII, FRENCH POLYNESIA, New Caledonia, NEW ZEALAND and the eastern Australian coast. A penal colony was established in New South Wales in 1788. Meanwhile, at home in Europe, Britain had acquired GIBRALTAR, the gate to the Mediterranean, in 1713 thanks to the Treaty of Utrecht.

The 18th century thus saw the fall of the first empire and the rise of the second. Modes of governance varied. In the West Indies, the system of local self-rule with the governor/elected assembly duo persisted. Nevertheless, in territories that had not been settled by the English (India) and in newly conquered colonies (Trinidad, MAURITIUS, SOUTH AFRICA), Crown Colony government came into effect. This meant that the governor-general was all-powerful and advised by a nominated council.

## 19TH CENTURY

The 19th century witnessed the development of British North America. By 1815, the British North American colonies were Nova Scotia, New Brunswick, Prince Edward Island, Newfoundland, and Upper and Lower Canada. The sparsely settled northwest areas were Hudson's Bay Company territory. British Columbia was created in 1858 once gold was discovered.

After rebellions in these colonies in 1837 and 1838, military governorship was replaced by civil administration. In 1867, Ontario, the Canadas, New Brunswick, and Nova Scotia confederated, thus becoming the first ever Dominion. A central government was formed, based in Ottawa. By 1873, Canada had expanded across the continent, though it remained low on the list of imperial priorities.

The British Empire in the 19th century was just as firmly rooted in the Caribbean as ever before. The West Indian islands under British control were either self-governing or Crown colonies but all still slave societies, with the number of blacks largely outnumbering the whites. In 1823, the Anti-Slavery Society was established to improve the lot of the slave population. Slave rebellions had become frequent in the colonies in the opening decades of the 19th century. Slaves in the British West Indies were finally freed in July 1834 and the apprenticeship system was introduced. But it failed and labor became scarce.

In the 1840s, LONDON, realizing how important it was to keep the plantations profitable, thus effected a reversal in the policy that had previously favored the ex-slaves. Duties on necessities and restriction on franchise qualifications were some of these measures. Indentured labor from other British colonies (India) was recruited to parry the attacks on British prosperity at home and in the Caribbean.

The black populations were increasingly disadvantaged; disease, death, riots, and rebellions became common. The Morant Bay rebellion in 1865 in Jamaica was one of the bloodiest uprisings of the century. As a result, Crown Colony government gradually became the preferred mode of governance in the British West Indies by the 1870s (Barbados, the Bahamas and British Guiana retained self-government) and remained more or less so until after World War I. But this did not put an end to the riots, and with recession, protest swelled as the 20th century dawned.

### AFRICAN EXPANSION

The 19th century was also a time of great expansion on the African continent. Britain had occupied the previously Dutch Cape of Good Hope in 1795. The Great Trek (1834–40) was an attempt on the part of the Afrikaners to leave the British behind and establish their own independent republics further inland. Britain annexed Dutch Natal in 1843. Self-government (involving whites only) was introduced in 1856. Transvaal was annexed in 1877. The Boers rebelled in 1880 and managed to regain almost total control of Transvaal in 1881. Zululand was annexed in 1887.

Representative government was introduced in 1893 as a result of the growing prosperity and industrialization (thanks to diamonds and gold discovered in the Transvaal) of the colonies. Britain became interested in acquiring northern territories perhaps equally rich in gold or minerals. Thus, Nyasaland (later MALAWI) became a protectorate in 1891 and North and

South Rhodesia (later ZAMBIA and ZIMBABWE) became British South African Company territory (a company founded by Cecil Rhodes). Three territories (*swaziland*, Basutoland (later LESOTHO) and Bechuanaland (later BOTSWANA) were known as the High Commission Territories.

Continuing conflicts with the Boer states convinced Britain that its presence in Africa had to be consolidated in the interests of global imperial influence. In 1899, Britain went to war with the Boer states (Transvaal and the Orange Free State) with this in mind. In 1900 both Transvaal and the Orange Free State were annexed. A peace treaty was signed in 1902. The South African colonies united in 1909.

As far as West Africa was concerned, by the end of the 19th century Britain had occupied the Gambia, Sierra Leone, the Gold Coast and NIGERIA. Trade increased, as did the infrastructure necessary to its development (railways, roads, and mining technology). White settlement, though, remained sparse, and policy was based on development by native populations and governance by local African rulers.

### THE ASIAN EMPIRE

Asia also became one of the prime sites of the growing power, force, and influence of Britain. Dutch colonies, namely SUMATRA, Malacca, Ambon, and Banda, were occupied by the Anglo-Indians with the assent of the exiled King William V at the end of the 18th century (1795). Britain acquired SINGAPORE in 1819 after intervention in internal politics. HONG KONG was acquired by cession in 1842 and returned to China in 1997. British India declared war on Burma in 1824 which culminated in the acquisition of Assam. By 1885, after three wars, the whole of Burma was British.

Toward the end of the 18th century, metropolitan intervention in India had taken many forms including the creation of the office of governor-general, the law courts, and the Indian Civil Service. The conquest ethos of the company was nevertheless alive and well and underpinned by the Royal Navy and the company's land armies. Sind was conquered in 1843 and the Punjab in 1849.

Governance in these acquired territories became rooted in the military even after the company lost its monopoly in India and China in 1813 and 1833. Native populations were paying the price, and discontent came to a head in 1857 with the Great Mutiny and Civil Rebellion. In 1858, the company was abolished and India became a Crown Colony under the direct rule of a secretary of state and the Council of India.



Over the next half century, British administrators ruled India hand in hand with the British army and Indian forces. Members of the Indian middle class were given the opportunity to become civil servants and so to participate in the administration of British India (their lower salaries also allowed for savings for the British government). The Indian National Congress was formed in 1885 and was a means of expressing claims for greater representation, demands that were partially satisfied in 1892.

In 1906, the All India Muslim League was formed to parallel the Hindu-dominated Congress. By 1909, Indians were present in the various executives. The move toward a federal system of government for India (with self-governing provinces and a central imperial government) was supported by Lord Crewe (secretary of state) and endorsed by the king. Further south, Ceylon (SRI LANKA) became a British Crown Colony in 1802. In the early 20th century, Ceylon began its campaign for independence which it obtained in 1948.

### PACIFIC EXPANSION

The empire was equally active and territorially expanding in the Pacific. The 19th century witnessed the transformation of a struggling penal settlement established in 1788 into a group of six self-governing and prosperous colonies (New South Wales, Victoria, Queensland, Western Australia, South Australia and Tasmania). AUSTRALIA was dependent on the Mother Country for defense purposes and returned the compliment whenever the empire required help in wars against for example, the Maori in New Zealand (1860s) or in South Africa (1899). This did not, however, prevent leanings toward independence at the end of the century. Federation came in 1901 but did not mean the complete severing of ties with Britain. British control of New Zealand was overseen by Sydney, but the territory was formally annexed by Britain in 1840. The Treaty of Waitangi, signed in 1842, laid out how colonization would proceed.

New Zealand became a Crown Colony but quickly progressed to a more democratic form of government in 1846, when assemblies were introduced. Maori challenge to British sovereignty came in 1863 with the Waikato war. The Maori were forced to retreat after a year's fighting. New Zealand acquired greater self-government in 1864. At the end of the 19th century, New Zealand had acquired Dominion status.

British possession of the Pacific islands was based on a policy of supporting existing native power bases and also meant the development of trade (whaling,

sandalwood). The Pacific islands under British control at the end of the 19th century were FIJI (1875), the SOLOMON ISLANDS (1893), the Cook Islands (1888), TONGA, PITCAIRN, and New Guinea (1884). The New Hebrides were under French and British control from 1906 onward. These islands, though, did not benefit from any concerted imperial effort in development or investment. French Polynesia, a British possession was annexed by the French in 1842 and New Caledonia in 1852.

At home in the Mediterranean, MALTA became a British possession after the Battle of Waterloo in 1815. CYPRUS was taken in 1878 and Britain occupied EGYPT in 1882 with the ruling khedive's assent. This state of affairs was a result of Britain's desire to control the Suez Canal (opened in 1869) and to protect trade interests. Britain declared Egypt a protectorate in 1914.

### 20TH CENTURY

At the dawn of the 20th century, the British Empire was extensive and prosperous, but changes were in the offing.

In India, reforms in 1919 and 1935 meant that Indians had acquired more decision-making power, though this did not mean that the two groups were on an equal footing, as the British diligently maintained their separateness. The Indian National Congress had become a more organized political party, acquiring more and more weight thanks to electoral successes.

The issue of imperial domination and Indian nationalism was articulated in various ways until Gandhi's policy of passive resistance (noncooperation and civil disobedience) united the Indians. World War II pushed Britain to propose in 1942 full Dominion status or secession in exchange for India's support. India refused and Gandhi's civil disobedience movement continued. The offer was renewed after the war as Britain was eager now to divest itself of the responsibility of maintaining British rule in India. Interest in the area (employment opportunities for the British, source of indentured labor for other colonies, strategic interest, source of trade, investment, and remittances) had started to wane by the 1930s. This was brought on by shifts in global economics as well as Britain's own reforms and finances.

Tensions between the Muslims and the Hindus concerning the shape of the new nation to come flared into violent encounters. Some British officials argued for a quick exit and partition. A separate Muslim state (PAKISTAN) was created, thus leaving the Indian National Congress with a secular state in 1947. India be-



*The British Empire as it appeared in 1930 still held numerous colonies and possessions around the world. The axiom “the sun never sets on the British Empire” was true before World War II.*

came a member of the new Commonwealth of Nations (1949), made up of the Dominions and the newly independent ex-colonies. This was the end of British rule in India and the beginning of a general move toward decolonization all over the empire that occurred over the next few decades.

In the Caribbean, the racist treatment of West Indian soldiers in wartime led (once they returned home) to a growing feeling of discontent with imperial domination. Strikes and protests by workers added to the rising dissatisfaction. By the 1960s, the British West Indies had acquired self-government. Most islands became independent in the 1960s and 1970s. The TURKS AND CAICOS ISLANDS, the CAYMAN ISLANDS, Montserrat, and the British Virgin Islands chose to remain colonies.

Similarly, in Southeast Asia, nationalism started to stir in the interwar period, but as in India, resistance to the empire was not the sole reason for British concessions. Britain’s incapacity to continue to defend its ex-

tensive empire became apparent as World War II was being fought. Burma gained independence in 1948 and did not join the Commonwealth. MALAYA became independent in 1957 and did. Malaysia (Malaya, Singapore, Sarawak, North Borneo) was created in 1961–63. Singapore, though, seceded from Malaysia in 1963. As a result of international movements, nationalist demands, and a lack of British funds and commitment, the empire in Southeast Asia was at an end.

The beginning of the 20th century witnessed the opening up of the interior in British West Africa (Gambia, Sierra Leone, the Gold Coast and Nigeria). Gold and tin became major exports from British West Africa. The British were in ultimate control even though a system of indirect rule was in effect. In the 1920s, the National Congress of West Africa was formed and formulated demands for better representation. As during World War I, British West Africa contributed to the second war effort, and when it ended,

access for Africans to the higher echelons of colonial government became easier. Reforms for representative government were introduced. The Gold Coast (GHANA) became independent in 1957, Nigeria in 1960, Sierra Leone in 1961 and Gambia followed in 1965, all becoming members of the British Commonwealth of Nations.

SOUTH AFRICA became a Dominion in 1909 and its sovereign status (like that of Canada, New Zealand and Australia) was acknowledged in the 1931 Statute of Westminster, which put the Dominions on a par with Britain. South Africa gradually became one of the richest countries in Africa, building its wealth on mining, cheap black labor, and discriminatory racist policy. The African National Congress was formed in South Africa in 1912 in response to the situation. In 1961, in the face of British condemnation of such policies, South Africa became a republic and left the Commonwealth.

Britain's domination of East Africa had been formalized in 1890 with the creation of a protectorate over what was then Buganda (UGANDA), KENYA, and TANGANYIKA. Zanzibar was annexed in 1896. The politics of identity became relevant in the 1920s in the East African colonies. Independence came to Tanganyika (TANZANIA) in 1961, to Uganda in 1962, and to Kenya in 1963.

The High Commission Territories of Swaziland (1968), Basutoland (1965), and Bechuanaland (1966) gained independence in 1960s. In North and South Rhodesia, the white population voted for self-government in 1923 when the company charter came to an end. North and South Rhodesia and Nyasaland federated in 1953 and became the Central African Federation.

The federation did little to better the situation of blacks in spite of economic growth. This obviously led to protest and the rise of nationalism. In 1964, Nyasaland (Malawi) and North Rhodesia (Zambia) became independent. White colonists in South Rhodesia illegally claimed independence in 1969, and the blacks gained control of their country, Zimbabwe, in 1980, which meant the close of the British Empire in Central Africa.

On the other side of the Atlantic, Canada became economically closer to the United States. Newfoundland, which had not been a part of the confederation, had acquired Dominion status in 1931 but relinquished government to Britain in 1933 as a result of economic difficulties. After a referendum in 1949, Newfoundland became a Canadian province. Cana-

dian citizenship was introduced in 1947 and British imperial referents slowly disappeared.

At the turn of the century, Australia and New Zealand were also both Dominions. Australia adopted the Westminster Statute in 1942 and New Zealand in 1947 (Canada in 1931). Both countries passed Constitution Acts in 1986, which severed the final links with Great Britain (though the queen is still head of state in all three countries). The Pacific Islands won independence between 1960 and 1980. Western Samoa was granted independence by New Zealand in 1962, the Cook Islands chose self-government in association with New Zealand in 1965, NAURU became a republic in 1968. Fiji acquired independence in 1970, PAPUA NEW GUINEA in 1975, Tonga in 1970, the Solomons in 1978, and VANUATU (New Hebrides) in 1980.

In the Middle East in 1936, Egypt and Britain signed a treaty that stipulated the withdrawal of the British from the cities but provided for the concentration of troops in the Suez zone. In 1954, the British agreed to withdraw from the canal. Aden was relinquished in 1967 and Great Britain withdrew from the Gulf in 1971 after the creation of the UNITED ARAB EMIRATES.

By the 1980s, Britain had relatively peacefully parted with almost all of its possessions. Today, the Commonwealth of Nations groups large and small ex-colonies in a network of free association. This active international organization is a legacy that attests to the bygone economic power and global spread of what used to be known as the British Empire.

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## British Indian Ocean Territory

THE BRITISH Indian Ocean Territory (BIOT) is an archipelago in the INDIAN OCEAN, south of INDIA, about one-half of the way from Africa to INDONESIA. On No-

vember 8, 1965, the British government created the (BIOT). The BIOT consisted of the Chagos Archipelago, excised from the British Crown Colony of Mauritius; and the Aldabra and Farquhar islands and Île Desroches, excised from the British Crown Colony of the Seychelles. Both MAURITIUS and the SEYCHELLES later claimed that these actions were in contravention to the United Nations declaration on the granting of independence to colonial countries. Approximately 1,200 residents of the islands, living as agricultural workers, were relocated by the British government to Mauritius and the Seychelles. Upon independence from Britain in 1968, Mauritius made immediate claim to the Chagos Archipelago and requested the resettlement of all indigenous populations. Subsequently, Britain transferred a number of the BIOT islands to the Seychelles when it attained independence in 1976. BIOT now consists of the six main island groups comprising the Chagos Archipelago.

The largest island of the Chagos Archipelago is Diego Garcia, reportedly named by Portuguese explorers in the 1500s. Portugal's claim lapsed and in the early 1700s the French claimed the islands. They administered them from Mauritius and eventually established copra plantations with slave labor. Britain obtained these islands along with several French claims in 1814. Britain leased the island of Diego Garcia to the UNITED STATES in 1966. The lease is for a 50-year period until 2016, with a 20-year extension available if both parties agree to continuation.

In 1971, the United States began to transform Diego Garcia into a naval support facility that soon included deepwater docks and an expanded runway. In the 1980s, the United States increased its presence on Diego Garcia by building new airfield facilities, and an air force satellite detection and tracking station, initiating long-range bomber operations, improving navigational aids, and increasing the port capabilities. The United States maintains a large amount of ground combat equipment on maritime prepositioning ships (MPSs) stationed in Diego Garcia. The United States has built an extensive military support complex that is operated jointly with the British. The facility and its capabilities are operationally invaluable to the U.S. military doctrine of global force projection and its current military operations in the MIDDLE EAST, South Asia, and throughout the INDIAN OCEAN.

Diego Garcia is a coral atoll with a near continuous land rim of approximately 40 mi (60 km). The Chagos Archipelago is made up of some 50 sand cays scattered along a large shoal area known as the Great Chagos

Bank. The whole feature covers some 22,000 square mi (56,995 square km) of the Indian Ocean. A wet tropical climate characterizes the area. Diego Garcia is a near pristine coral atoll ECOSYSTEM.

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## Brunei

**Map Page** 1124 **Area** 2,055 square mi (5,770 square km) **Population** 358,098 **Capital** Bandar Seri Begawan **Highest Point** Bukit Pagon 6,105 ft (1,850 m) **Lowest Point** 0 m **GDP per capita** \$18,600 **Primary Natural Resources** petroleum, natural gas.



THE SULTANATE of Brunei is one of the world's smallest countries, but also one of the world's richest. A major landpower in the 15th century, the territory ruled directly by the sultan is now smaller than LUXEMBOURG, but its economic impact in the region is far greater due to the blessings of abundant petroleum and natural gas reserves. Its full name, Brunei Darussalam, is a compound of a Sanskrit name (possibly meaning "sea people" or the name of a local tree that also gave its name to the entire island of Borneo), plus the Arabic for "abode of peace," added to the name by Muslim sultans in the 15th century.

Brunei is one of the four political components that make up the island of Borneo, along with Kalimantan (part of INDONESIA), and Sabah and Sarawak, two states of the federation of MALAYSIA. Sarawak surrounds Brunei and in fact divides it into two pieces. Sabah, Sarawak, and Brunei were at one time all component parts of the British East Indies colonies, but Brunei declined to join the Malay federation in 1961 and remained a British protectorate until 1984, preferring to rely on its own natural resources.

These resources, in combination with a relatively small population, make Brunei's per capita income one



of the highest in the developing world. The sultanate has been ruled by the same family for six centuries, and the sultan is considered one of the richest individuals in the world: It is said he earns \$100 per minute from oil. Brunei's oil production is estimated at 163,000 barrels a day; its output of liquefied natural gas is the fourth largest in the world.

The country consists of a flat coastal plain along the South China Sea in the western part of the country, with some hills further inland. Mountains rise in the eastern segment of Brunei, which is also the most undeveloped and inaccessible part of the sultanate. An equatorial climate gives the area abundant rainfall, and most of the country remains heavily forested, with mangrove swamps along the coast. Most of the people live in the capital of Bandar Seri Begawan, along with its chief port of Maura, 25 mi (41 km) to the northeast.

The other major town is Seria, the center of the oil and gas industry, in the western part of the country. Bandar includes great contrasts, between the sultan's palace and the glittering Sultan Omar Ali Saifuddin Mosque and the world's largest stilt village, Kampung Ayer. This village, in existence for 400 years and providing housing for about 30,000 people, was declared a national monument in 1987 and is the most popular tourist attraction in the country.

His Majesty Sultan Haji Hassanal Bolkiah Muiz'zaddin Waddaulah, the Sultan and Yang Dipertuan of Brunei Darussalam, leads a relatively extravagant life, but is generally ignored by the religiously conservative Islamic population. The sultan is the sovereign in more than just name: Elections have been suspended since 1962, and there is little sense of change in the near future.

At its height in the 15th century, the sultanate controlled the entire north and west coast of Borneo, plus the Sulu archipelago (now in the Philippines). After its first encounter with European colonial powers—it was briefly occupied in 1580 by Spain—Brunei entered a long period of decline, and by the 18th century was a principal center for piracy and slave trade. Labuan, an island commanding the entrance to Brunei Bay, was ceded to Great Britain in 1846 chiefly to protect against this, and by 1888 the entire state was a British protectorate. Economically, Brunei was known only for its exports of gambier, a dye produced from mangrove trees used in dying of leather.

Then, in the early 20th century, large oil reserves were discovered, first onshore in the region of Seria and Kuala Belait, but mostly offshore by the 1990s. The British Malayan Petroleum Company was the

greatest producer of crude oil of any British colony in the post-World War II era, but it is Royal Dutch Shell that has become the major company involved in Brunei's oil industry. Revenues derived from this company alone have been significant in what is sometimes called the "Shellfare State," in which all local residents enjoy free education, health care, and no taxation. Local residents (mostly of Malayan extraction) are less willing to work in industry, so there is a sizable immigrant community of Filipinos and Thais. Oil reserves are expected to last 40 years, but the sultan's government is already implementing a National Development Plan to reduce Brunei's dependence on oil-based industries; \$7.2 billion has reputedly been allocated for this plan, investing in production of rice, fruit, fisheries, and livestock—in 1981 the government purchased a cattle ranch in northern Australia that is larger than the entire country—with an equal push to boost tourism.

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## Buenos Aires

BUENOS AIRES IS the largest city in ARGENTINA, and as part of a federal district, it serves as the country's capital. The city's name means "good airs" and derives from the name of a patron saint of navigators known as Nuestra Señora Santa María del Buen Aire. Measuring 77 square mi (199 square km), the city is located in eastern Argentina, near the South ATLANTIC OCEAN, just south of Argentina's border with URUGUAY.

In 1536, the Spanish explorer Pedro de Mendoza led an expedition that founded the city of Buenos Aires on the banks of the Río de la Plata. This initial settlement failed after five years because of a lack of supplies and conflicts with the native inhabitants. The Spanish settlers fled Buenos Aires for the fortified city of Asunción. In 1580, Juan de Garay led a new expedition from Asunción that reestablished Buenos Aires. The new settlers began to exploit the pastoral animals that had multiplied since being left by the earlier settlers.

For more than 200 years, Buenos Aires grew slowly. While the city possessed a good port, it was

largely excluded from the highly regulated Spanish colonial system of trade. Spain permitted only trade through certain ports in the New World and in SPAIN. As a part of the Viceroyalty of Peru, Buenos Aires was governed from Lima and its port of Callao. Thus, to obtain European goods, *porteños*, as residents of Buenos Aires are known, had to wait for them to be shipped through Callao and then by oxcart to Buenos Aires, which could take six months. To export their goods, residents of Buenos Aires also had to ship them through Callao and then to Spain.

Before the second half of the 18th century, Buenos Aires had little contact with the silver mining regions of the viceroyalty. Instead it developed an economy based on ranching and contraband trade. This contraband trade, especially with Brazil and the Caribbean islands, allowed *porteños* to thrive. In 1618, the city became the seat of an imperial governorship. By the 18th century, they were exporting cereals, hides, and dried beef. By the mid-1700s, the city's population had reached 20,000. In 1776, as part of a series of reforms implemented by the Spanish government, Buenos Aires became the capital of the new Viceroyalty of the Río de la Plata. The city now had administrative authority over much of southern South America. With its new status, legal trade greatly expanded and Buenos Aires prospered from direct trade with Spain and with the mining regions of South America. Economic prosperity also led to increased population, which reached 42,500 in 1810.

In 1806 and 1807, British forces attacked the city. Local militias succeeded in repelling the attackers, contributing to the *porteños'* sense of pride and nationalism. In 1808, city residents opposed Napoleon's invasion of Spain, and in 1810, the town council cut its formal ties with Spain, replacing the Spanish viceroy with a colonial-dominated junta. For the next decade, the city was a center of revolutionary activity. However, the interior provinces did not immediately follow the lead of Buenos Aires. Finally, in 1816, the provinces also declared their independence and Buenos Aires became the capital of the newly independent United Provinces of the Río de la Plata. Much of the first half of the century was marked by political and military conflict between *unitarios* and *federales*. The *unitarios* were those who favored a strong central government at Buenos Aires, while the *federales* preferred provincial autonomy. Buenos Aires generally dominated the struggle. In 1880, the city separated from the province of Buenos Aires and became Argentina's national capital as part of a federal district.

In the second half of the 19th century, Buenos Aires prospered and grew. By 1860, the city had more than 100,000 residents, and by the early 20th century, the population had surpassed one million. Several factors contributed to the transformation of the city, all of which were reflections of the economic prosperity of the surrounding countryside.

One change was the arrival of massive numbers of immigrants from Europe and elsewhere. About 80 percent of the immigrants came from Spain and ITALY. By 1914, half of the city's population was foreign born. Often unable to buy land in the countryside, many immigrants settled in Buenos Aires, as there was a need for labor in the city's port, industries, and service sectors. Many older sections of the city came to be dominated by foreigners.

A second change was the flow of wealth into the city. This wealth can be seen in the construction of numerous great mansions in the city. Indeed, Buenos Aires came to be a symbol of great wealth and the phrase "to be rich as an Argentine" could be heard on the streets of Paris. A third change was the spatial change that took place. Buenos Aires sought to copy the model of PARIS, especially as it began to prepare for its centennial celebration in 1910. Thus, the city constructed a subway system and broad avenues like those in the French capital. Other improvements included sanitation, gas, electricity, and water.

By 1914, Buenos Aires had reached a population of over 1.5 million, making it one of the 10 largest cities in the world. About one-fourth of Argentina's entire population lived in the Buenos Aires metropolitan area, which was seven times larger than the second biggest city in the country. Several key developments marked the 20th century.

First was a change in the source of newcomers to the city. After about 1930, European immigration virtually ended. Migrants from the interior provinces of Argentina filled the city's labor demands. Others came from the neighboring countries of Uruguay, PARAGUAY, and BOLIVIA. Most of the new arrivals were mestizos. This racial difference led to frequent social conflict. Most of the migrants were poorly educated and had few job skills, making it difficult for the urban economy to employ them. Many of these migrants became supporters of Juan Peron, often viewed as the champion of the poor.

A second, related, change was growing urban poverty. Despite the support of politicians such as Juan Perón, the new migrants remained poor. Most found the inner city too crowded. Instead, they chose to live

in the growing shantytowns that surrounded Buenos Aires, known as *villas miserias*.

A third key development in the 20th century was a change in urban transportation. Like many other modern cities, Buenos Aires came to be dominated by automobiles and buses, replacing the electric streetcar system. However, Buenos Aires lacks a major freeway system. A network was planned after World War II, but it was never built. The building of the Metropolitan Railroad in 1979 helped somewhat. However, by the end of the 20th century, traffic problems and urban gridlock were commonplace in the Argentine capital.

A final development was industrialization. In 1914, the city had 17,000 industrial establishments that employed some 300,000 people. By the 1960s, there were more than 70,000 establishments providing jobs to more than 700,000 *porteños*. Some 40 percent of all Argentine industry was located in the city. Such industrialization reinforced the flow of migrants to the city. By the end of the 20th century, the metropolitan area had more than 11 million inhabitants, making it one of the largest cities in the world.

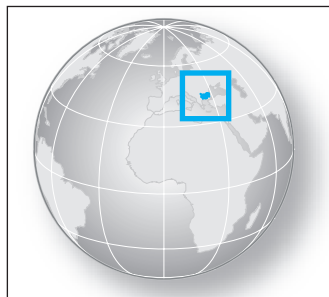
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## Bulgaria

**Map Page** 1133 **Area** 42,900 square mi (111,910 square km) **Population** 7,537,929 (2004) **Capital** Sofia **Highest Point** 9,596 ft (2,925 m) **Lowest Point** 0 m **GDP per capita** \$7,600 **Primary Natural Resources** bauxite, coal, copper, lead, timber.



BULGARIA IS ONE OF 10 countries in the Balkan Peninsula in southeastern Europe. The peninsula is a mountainous region with river systems flowing in all directions. As a land bridge between Europe and Asia, the Balkans witnessed a long history of warfare and territorial struggle. A number of conquerors in past centuries have exercised control over the region. Once a Roman province, the Balkans later became part of the Byzantine Empire, and still later came under the control of the Ottoman Turks. Bulgaria, formally named the Republic of Bulgaria and known as the People's Republic of Bulgaria when the Soviet Union dominated Eastern Europe (1946–90), is a heavily mountainous country, with its eastern border on the BLACK SEA, and is bounded on the north by ROMANIA, on the west by SERBIA AND MONTENEGRO (formerly the Federal Republic of Yugoslavia), and on the south by TURKEY and GREECE.

Bulgaria has a significant agricultural base in addition to a varied array of mineral resources from mining. Both industrial and agricultural activity increased dramatically during the time Bulgaria was a satellite of the Soviet Union. Two of the leading industrial centers are Varna and Burgas, both on the Black Sea coast. With the rise of industry, Bulgaria has experienced its share of environmental degradation. Rivers are polluted from the discharge of heavy metals, nitrates, and other industrial wastes, as well as raw sewage in some regions. Air pollution from industrial discharges and automobile exhausts has contributed to the presence of acid rain and subsequent widespread deforestation. The country is working to alleviate these environmental problems in part from funds received in the 1990s from the European Community.

A 2004 program has the Danube Regional Project working in close partnership with the International Commission for the Protection of the Danube River on identifying and remedying environmental problems in that world-famous river. The work by these organizations, is expected to expand to Romania, CROATIA, Serbia and Montenegro, and BOSNIA AND HERZEGOVINA, all of which are, along with Bulgaria, in the DANUBE RIVER basin. Bulgaria signed the Kyoto Protocol and is a member country of a number of other international environmental agreements. Bulgaria joined the NORTH ATLANTIC TREATY ORGANIZATION (NATO) and is expected to become a member of the EUROPEAN UNION (EU).

The population of Bulgaria reached its highest total in the mid-1980s at nearly 9 million. Since that time, the population has steadily decreased due to the emigration of large numbers of Turks and ethnic Bulgari-

ans and several years in which the death rate has surpassed the birth rate. Estimates for mid-2004 indicate a birth rate in Bulgaria of 9 per 1,000 people in the country and a death rate of 15 per 1,000. Bulgaria's rate of natural increase (the difference between birth and death rates) in percentage form is -0.6. Recent estimates of regional and country populations for 2050 suggest that Bulgaria will experience the highest percentage loss of any country in the world. Its total population in that year is predicted to be approximately 5 million, a 44 percent decline from its high point of 9 million in the mid-1980s. In fact, all of the countries in Eastern Europe are predicted to decline in population by 2050, and the whole of Europe's population will drop from 728 million in 2004 to 668 million in 2050. All other major world regions are expected to increase in population over this same period.

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## Burkina Faso

**Map Page** 1113 **Area** 105,840 square mi (274,200 square km) **Population** 13,228,460 (2003) **Capital** Ouagadougou **Highest Point** 2,457 ft (749 m) **Lowest Point** 656 ft (200 m) **GDP per capita** \$1,100 **Primary Natural Resources** manganese, limestone.



A **LANDLOCKED** republic located in West Africa, bordering GHANA, CÔTE D'IVOIRE, and TOGO to the south, BENIN to the southeast, NIGER to the east, and MALI to the north and west. In addition to the capital, Ouagadougou, major cities include Bobo-Dioulasso, Koudougou, Kaya, and Ouahigouya. The country's terrain is largely semidesert, with less than 10 percent of the land arable without IRRIGATION.

The country has several unnavigable rivers: the Komoé (Comoé) River, which flows through Côte

d'Ivoire; and the Mouhon (Black Volta), Nazinon, and Nakambe (White Volta) rivers, which join in Ghana to form the Volta. The country's predominantly rural population is split nearly in half in terms of religion, with 50 percent of the population practicing Islam, 40 percent practicing indigenous faiths, and the remaining 10 percent Christianity, mostly Catholicism. There are at least 50 recognized ethnic groups in Burkina Faso, dominated by the Mossi, who make up 40 percent of the population. The remainder of the population is distributed among the Gurunsi, Senufo, Lobi, Bobo, Mande, Fulani, and numerous smaller ethnic groups. French is the country's official language, though Oyula is also spoken.

While Burkina Faso has considerable mineral resources, the country remains one of the poorest in the world. Agriculture is difficult, as most of the land is untenable, and drought has prevented major irrigation projects from being undertaken. Because of the lack of agriculture, Burkina Faso must import most of its food, which contributes significantly to the country's increasing debt.

In the 12th century, most of the territory in the western part of Burkina Faso was seized by the Mossi. The states of Ougadougou, Tengkodogo, Yatenga, and Gourma in the east remained in power for approximately 500 years, the Mossi minority using religion and strong, efficient militaries to maintain control. They successfully repelled attempts by the Mali and Songhai Empires to take control of the area from the 14th to the 16th century and remained in power after the trans-Saharan trade diminished in the 17th century. Not until the 19th century, with the arrival of the French, were the Mossi states dissolved: Yatenga was made a protectorate through peaceful negotiations in 1895, Ougadougou was taken by force in 1896, and Gourma was annexed, along with several other territories, in 1897.

Burkina Faso was split and redrawn several times during the colonial period: Its current borders were established in 1947. In 1960, the country achieved its independence, calling itself Upper Volta, after the territory name given to it by the French.

The country experienced considerable political upheaval in the decades following independence. The country's first president, Maurice Yaméogo, was ousted in a bloodless coup in 1966 by Sangoulé Lamizana, a colonel in Yaméogo's army, which began a trend of military takeovers in the country.

The country was renamed Burkina Faso in 1984 in symbolic rejection of the country's colonial past, but



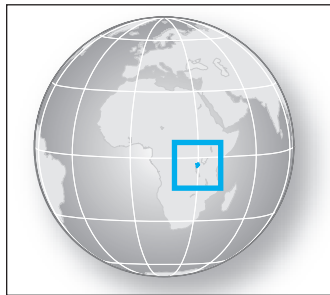
Burkina Faso remains economically dependent upon FRANCE. Attempts at attracting foreign investment and multiparty elections in 2002 have provided Burkina Faso political stability.

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## Burundi

**Map Page** 1114 **Area** 10,759 square mi (27,830 square km) **Population** 6,096,156 **Capital** Bujumbura **Highest Point** 8,760 ft (2,670 m) **Lowest Point** 2,539 ft (772 m) **GDP per capita** \$600 **Primary Natural Resources** coffee, tea, cotton, minerals.



**BURUNDI IS A** landlocked country in eastern Africa. It has borders with the Democratic Republic of the CONGO, RWANDA, and TANZANIA. Burundi is slightly smaller than the state of MARYLAND, and the economy is mostly agricultural. The 1990s represented a tragic time for Burundians. Ethnic genocide in Burundi and neighboring Rwanda contributed to a loss of over 1 million people and displacement of thousands because of an intractable war between the Tutsis and Hutus. Some scholars have speculated that tensions between the Tutsis and Hutus began during the colonial era, especially when the Tutsis were granted power and privilege positions over other ethnic groups. Further escalating the tensions was an institutionalized colonial racial policy that denigrated the Hutus and Twas. Colonialism was essentially a system of political, economic, and cultural domination forcibly imposed by a foreign minority on an indigenous majority.

The country consists of three major ethnic groups: Hutus (85 percent), Tutsis (14 percent), and Twas (1 percent). While Hutus represent the largest ethnic group, Tutsis represent an aristocratic class with lots of economic and political influence in the country. In fact, for many years, Hutus served as servants of local Tutsi aristocrats. Until 1966, the leader of the Tutsi aristocratic

class was the *mwami*, or king. The process of colonialism began when the Burundi kingdom was incorporated into German East Africa in the 1800s. The Germans, and later Belgians, took over the kingdom and established a policy that cemented Burundi's traditional rigid social hierarchy among the Tutsis, Hutus, and Twas.

In the 1950s, Prince Louis Rwagazore, a Tutsi, formed a movement known as UPRONA, with the sole purpose of improving the Tutsi-Hutu relationship. Unfortunately, Rwagazore's untimely assassination ended any peace gesture between Tutsis and Hutus. Despite the setback, UPRONA led the country to independence in 1962. King Mwambutsa IV became the first head of state after independence. Under Mwambutsa's administration, efforts to maintain harmony between Tutsis and Hutus failed in 1965.

First, Hutus soldiers staged a military coup and succeeded in forcing Mwambutsa to go into exile. Second, Tutsi soldiers mounted a counterattack and ended the power grabbed by the Hutus. In the aftermath of the successful counterattack, revenge killings engulfed the country and continued for many years.

In 1993, Burundi's Hutu president was assassinated after only four months in office, thus leading to widespread ethnic violence all over again. An estimated 200,000 Hutus were killed in this round of ethnic strife. The killings and reprisals have created an atmosphere of political instability and uprooted Hutus, many of whom have become refugees in neighboring countries.

Burundi's future looks bleak because of continued ethnic violence and political instability. Despite its rich mineral resource base and generous foreign aid, Burundi is regarded as a very poor country. Additionally, rapid population growth and inadequate agricultural land are hampering efforts to formulate development strategies. In 2002, the Burundi government, dominated by Tutsis, signed a cease-fire agreement with three Hutu groups to end the violence. However, implementation of the agreement is proving to be very difficult, hence delaying any hope for a peaceful end to the conflict.

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## California

THE MOST POPULOUS state in the UNITED STATES, California also has the richest and most urbanized citizenry. It is the third largest state, famous for its climate, unique industries, agriculture, geographic variety, and lifestyles. California covers 158,706 square mi (411,049 square km), is 252 mi (406 km) at its widest point, and is 824 mi (1,326 km) in length. Its western border is the PACIFIC OCEAN, and the state has 1,931 km (1,200 mi) of shoreline. On the east, most of California borders NEVADA, and in the southeast, the Colorado River separates the state from ARIZONA. OREGON shares the northern boundary, and to the south, California's border is international; the Mexican state of Baja California lies across it. The state capital is at Sacramento, an inland city on the Sacramento River, near the spot where gold was discovered in 1848. Nicknamed "The Golden State," the official motto is "Eureka!" meaning "I found it!"

### GEOGRAPHIC DIVERSITY

An indication of California's geographic diversity is that the highest and lowest points in the contiguous 48 states lie within 85 mi (137 km) of each other in California: Mount Whitney, at 14,505 ft (4,421 m) in height, and Death Valley, at 282 ft (86 m) below sea level. Death Valley, a national park, also is the site of

the highest temperature ever recorded in the United States: 134 degrees F (56.7 degrees C) in 1913.

Almost 28 million acres, or 27.7 percent of the land in California, are devoted to farming. Much of this is in the Central Valley, which extends 450 mi (724 km) along the state's interior, between the coastal and Sierra Nevada mountain ranges. Many large rivers, including the Sacramento, Merced, American, Feather, Tuolumne, and San Joaquin, water the valley, which is called the Sacramento Valley in the north and the San Joaquin Valley in the south. The DELTAS of the Sacramento and San Joaquin rivers divide the two valleys. Grapes are the principal cash crop, bringing in over \$2.5 billion per year; California produces 91 percent of the world's grapes. Lettuce, almonds, strawberries, flowers, tomatoes, and hay follow in order of sales dollars.

The Sierra Nevada are among the highest mountains in the United States and extend in a swath 40 to 80 mi (64 to 129 km) wide, and 430 mi (692 km) long. The range begins south of the active VOLCANO Lassen Peak in the north, slopes upward east of the Central Valley, and continues south to the Tehachapi Mountains. The mountain range's eastern edge is sheer and marked by sudden drops in altitude. Carved by glaciers and continually uplifted by tectonic activity, the Sierra Nevada contains 13 peaks that stand over 14,000 ft (4,267 m) tall. The range is the site of three national



*California's Golden Gate Bridge and San Francisco are one of the gateways on the West Coast of the United States.*

parks: Yosemite, King's Canyon, and Sequoia, as well as Lake Tahoe, a freshwater lake astride the California-Nevada border, 6,229 ft (1,899 m) high, and 1,645 ft (501 m) deep.

North of the Sierra Nevada is an active volcanic area that includes Mount Lassen, Mount Shasta, Medicine Lake Volcano, the Lava Beds National Monument, and the southern edge of the Cascade Range. Directly east of the Sierra Nevada lies the western edge of the Great Basin, a sparse, arid area that extends across much of Nevada and UTAH. It is also called the Trans-Sierra Desert. Both areas are sparsely populated.

California's coastline includes the state's four largest cities: Los Angeles, San Diego, San Jose, and San Francisco, listed in order of population. Three of the four are port communities, which combined, see over \$350 billion in import and export trade per year. Urban areas can extend up to 40 mi (64 km) inland. The coastal areas of California are also made of sandy beaches and dune areas, wetlands, and bluffs.

The Pacific Ocean coast in California is lined with mountain ranges, created by either upthrust magma or the more recent interaction of two tectonic plates, the Pacific Plate and the North American Plate. These mountains affect the state's climate by forming a barrier that prevents the ocean's moisture and storms from traveling further inland. In the far north the Klamath Mountains continue into Oregon. The Coast Ranges are a series of mountains north of San Francisco that reach heights of up to 4,000 ft (1,219 m): the Diablo, Sierra Madre, San Rafael, Gabilan, Santa Cruz, and Santa Lucia mountains.

Below San Francisco, the Transverse Ranges include the Santa Monica Range, which extends offshore to the northern Channel Islands. (While the names of cities and mountains are sometimes the same, they are not necessarily in the same area; the city of Santa Monica is far to the south in Los Angeles County.) Some of the other ranges in the Transverse group, which reaches heights of 10,000 ft (3,048 m), are the Santa Barbara, Santa Ynez, Tehachapi, Topatopa, San Gabriel, and San Bernadino mountains, which stretch as far south as Los Angeles County. South of Los Angeles, the Peninsular Ranges, with altitudes as high as the Transverse Range, includes several groups leading inland as far as the Coachella Valley, as well as the Santa Ana Range that extends out to sea, forming the southern Channel Islands. This group of mountains, which includes the San Jacinto, Santa Rosa, Agua Tibia, and Laguna, continues south into Baja California.

A large portion of the state south and east of the Sierra Nevada comprises the Mojave Desert, which covers one-sixth of California's land mass. Death Valley, the Joshua Tree National Park, and the Havasu National Wildlife Refuge are found here, as well as several military installations, testing grounds, and Indian reservations. The Mojave Desert takes up 25 million acres in California and extends into Nevada and Utah as well. It averages 2,000 to 3,000 feet (610 to 914 m) above sea level, although some areas have much higher and lower altitudes.

South of the Mojave and east of the southern Peninsular Range is the Colorado Desert. This area, which is actually an extension of the Sonoran Desert of Arizona and MEXICO, is less than 1,000 ft (305 m) above sea level in most places. Cotton is a major agricultural product of this thinly populated area.

## CLIMATE

With so much geographic variation, generalizations about California's climate are difficult to make. In most cities of California, though, especially along the coast, winters are much milder than in other areas of similar latitude in the United States. In January, southern metropolitan areas average temperatures of 49 to 65 degrees F (9.5 to 18.3 degrees C), while Bishop, a city east of the Sierra Nevada Mountains in the Great Basin, sees a range of 22 to 54 degrees F (-5.5 to 12.2 degrees C).

In Eureka, a coastal city in the north, the temperature is 41 to 55 degrees F (5 to 12.8 degrees C). Normal high temperatures in July range from 96 to 99 degrees F (35.5 to 37.2 degrees C) in some Central Val-



ley and desert cities, to 63 degrees F (17.2 degrees C) in Eureka. July highs in Los Angeles average 84 degrees F (29 degrees C), and in San Francisco, 68 degrees F (20 degrees C).

Extreme temperatures occur in Death Valley and the high Sierras. The summer heat in Death Valley averages over 100 degrees F (37.8 degrees C), and the area usually gets less than 2 in (5 cm) of rain per year. Higher elevations of the Sierra Nevada get between 70 and 80 in (178 and 203 cm) of precipitation per year, most of it as snow, while desert regions might receive no more than 3 or 4 in (7.6 to 10.2 cm). Along the coast, more rain falls in the north than the south; San Diego, near the border with Mexico, receives less than 11 in (28 cm) per year, while San Francisco gets over 22 in (56 cm).

California was home to Native Americans for at least 15,000 years, and possibly much longer. They formed diverse groups; by the time Europeans encountered the natives of California, there were probably 300,000 people living in the area, speaking over 100 distinct languages. An estimated 500 groups or tri-belets, each with their own customs, beliefs, diets, values, and survival techniques, dotted the landscape. The artistic and complex society of the Chumash on the central coast, who built plank canoes to reach coastal islands, was very different from the small family groups of Paiutes who lived east of the Sierra Nevada Mountains, where resources were scarce. Tribal lifestyles in California were shaped by the land and weather.

Spanish explorer Juan Rodríguez Cabrillo was the first European to sail up the coast of California in 1542. He entered San Diego's harbor, passed San Francisco Bay twice without notice, and died on one of the Channel Islands. Spain claimed the land but saw it only as a port for the Manila galleons that sailed annually between Asia and Mexico. Over two centuries passed before Spain made an attempt to colonize the land they called Alta California. Fray Junípero Serra and soldier Don Gaspar de Portolá led a team of priests and military men north, founding 21 missions, four presidios (forts), and several pueblos (towns) in California through the 1790s.

Along the coast, the Spanish settlements changed and sometimes destroyed native cultures when they attempted to convert, confine, and employ them. Tribes not directly tied to the missions were forced to move or adapt their lifestyles to an environment that changed with the Spanish introduction of new plants, trees, herd animals, and pigs.



*San Francisco's Chinatown reflects the myriad of people and cultures that make up California's population geography.*

Under the Spanish, California's economy came to depend on cattle ranching and the sales of cowhide and tallow. In many inland areas, though, the native groups continued to live as they had for centuries. When Mexico declared independence in 1821, the new government allowed the missions to decline and awarded huge land grants to Mexican citizens.

A small insurrection in 1846 called the Bear Flag Revolt, led by John C. Frémont and other Americans, claimed California for the United States but was abandoned with the outbreak of the Mexican American War. A year later the Treaty of Guadalupe Hidalgo ceded California to the United States as part of the war's settlement. At practically the same time, gold was discovered near Sacramento, on land owned by Swiss immigrant John Sutter. Thousands of gold seekers (called 49ers the first year) flooded California. The state was transformed by the sudden influx of young, mostly white males. San Francisco Bay became a graveyard of abandoned ships; crews as well as passengers flocked to the gold "diggings" along the American, Feather, and Sacramento River and their branches. San Francisco itself boomed from a hamlet of 400 in 1847 to a city of 15,000 by the fall of 1849. In the search for gold, rivers were dammed and diverted, and choked with debris. Channels and pits were gouged out of the landscape, and hillsides were washed away by hydraulic mining. Arsenic-laden piles of tailings—the refuse of processed ore—poisoned land and water.

California became the 31st state in September 1850, and the Mexican citizens who stayed lost most of their lands. A free state, it sided with the North dur-

ing the Civil War but was far from the battlefields. The state continued to grow even after mining lost its appeal, but men outnumbered women for many years, Native populations dwindled, and nonwhites were usually denied citizenship and rights. Chinese immigrants, 25,000 of them almost all male, arrived by 1852, and thousands more were brought to the state in the 1860s to build railroads.

The railroads made millionaires of some and opened the state to more migration from the east. Boosterism (promoting California) and progressivism flourished near the turn of the 20th century. The new film industry centered itself in Hollywood and became a defining symbol of the state. After the 1906 earthquake and fire in San Francisco, the temblor was also associated with the state. California became a leading producer of wheat, fruits, nuts, and vegetables, and water availability became a problem, addressed by projects such as the damming of Hetch Hetchy Valley, and the Los Angeles Aqueduct, which devastated the Owens Valley to bring water to Los Angeles.

Prejudice against the Chinese at the state and national levels led to a halt in immigration from China, and by 1910, 40,000 Japanese laborers entered California to work. The state, always prey to a “boom and bust” cycle of growth, barred and discriminated against immigrants in economic downturns. During the Depression, interstate migrants from the Dust Bowl were turned away at the border.

World War II brought the aircraft industry to California, along with increased shipbuilding and weapons production. The sunny climate and available land for training and testing were factors that attracted wartime industry, and California remained a major center for military and defense work into the 21st century. This brought many minorities to the state to fill jobs. Much of California’s large Japanese population, however, was forced into internment camps during the war.

After the war, sprawling suburbs grew around cities to accommodate workers of the new technical and aerospace industries. California’s liberal governor Earl Warren, a Republican, like most of his predecessors since the Civil War, left office to lead the U.S. Supreme Court in 1953. California emerged as center of protest and innovation during the 1960s, and San Francisco became a haven for the counterculture movement.

The Watts riots in Los Angeles focused attention on civil rights issues, the free speech movement at the University of California at Berkeley turned to active protests and sit-ins, the Black Panthers and Chicano

student organizations were formed, and the American Indian Movement (AIM) occupied Alcatraz Island, a former prison in San Francisco Bay.

The technical industries of California expanded in the 1970s and 1980s to include new computer and microchip businesses, and Silicon Valley in the north became a major center of information technology. Environmental concerns over toxic dumping and emissions, smog, and pesticide use in agricultural areas rose during the same period. Immigration, both international and interstate, continued to inflate the population. In the 1970s, San Francisco became a center for the gay community, and the sexual orientation of the city’s residents has been at least 15 percent gay since. In 2004, the city issued 4,037 same-sex marriage licenses before ordered to stop by the state supreme court.

In the 1990s, Los Angeles suffered further riots, and the state experienced natural disasters, including large earthquakes, fires, droughts, flooding, and mudslides, combined with economic ups and downs. California shares the same concerns and challenges as the rest of the nation as it enters the 21st century, but with a larger share of population, land, and business than most other states, California has become both a leader and a test case for new ventures, ideas, and lifestyles.

## POPULATION

As of July 2003, the state was home to 35,934,000 people: 28 percent, or 10 million people, live in Los Angeles County; six other counties have over 1 million residents. For historical context, after the initial gold rush, California in 1850 had 92,000 people (excluding Native Americans), by 1870, 0.5 million, and in 1900, 1.5 million people. In 1941 the state was home to just over 7 million people; by 1957 that figure had doubled. The population in 1970 was 20 million, in 1980 almost 24 million, and in 1990, 30 million. California’s population is slightly younger than the national average, with only 10.6 percent over age 65 (nationally, 12.4 percent are over 65), and 27.3 percent under age 18 (compared to 25.7 percent nationally).

About half of the new residents in California in 2003 were immigrants; 49 percent of that number came from Latin America and the Caribbean, and 40 percent came from Asia. California has had the highest population of immigrants for several years; over 27 percent of immigrants to the United States live there. The 2000 U.S. census reports that of almost 35 million people in California, 16 million claimed to be white, 11 million Hispanic, 2.2 million Black, and 3.7 million Asian in ethnicity. Over 900,000 said they were mul-

tiracial, 104,000 were Hawaiian or Pacific Islanders, and 179,000 claimed American Indian or Native Alaskan heritage.

## ECONOMY

California boasts the fifth-largest economy in the world and the largest in the United States. Its gross state product in 2003 was \$1.4 trillion. Although a 2004 study put California second (behind Massachusetts) in its ability to attract and develop high-tech business, all projections are impacted by fiscal and budget problems that led to the 2003 recall election of the state's governor, Gray Davis. Davis was replaced by Republican Arnold Schwarzenegger, who proposed massive cuts and changes in the state's spending to bring the deficit under control.

Tourism, the entertainment business, aerospace, electronics, and high-tech industries are all areas in which California dominates other states. California's agricultural production, including both farm and cattle products, exceeded \$27.6 billion in 2001. There were 88,000 farms in the state, covering 27.7 million acres. California produced over 90 percent of the world's grape products, and in 2003, almost 500 million gallons of California wine were shipped worldwide. In 2001, about 19 percent of Californians worked in trade, transportation and utilities, 15 percent provided professional services, 15 percent worked for the government, 11 percent for manufacturers, and 10 percent in education and health fields.

Over the years, the unemployment rate has remained higher than the national average; in 2003 California saw 6.7 percent unemployment, compared to the nation's 6.0 percent. Average personal income in California has historically been higher than that of the rest of the United States, but the percentage has steadily declined. In 1955, Californians earned 24.5 percent more per capita, but in 2002 a Californian earned only 6.7 percent more than people in other states, on average.

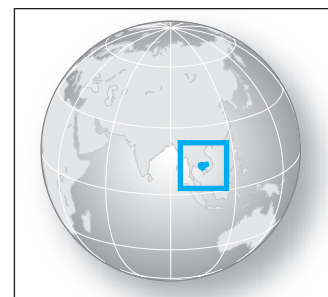
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## Cambodia

**Map Page** 1124 **Area** 69,884 square mi (181,040 square km) **Population** 13,124,764 (2003) **Capital** Phnom Penh **Highest Point** 5,938 ft (1,810 m) **Lowest Point** 0 m **GDP per capita** \$278 **Primary Natural Resources** timber, gemstones, hydropower potential.



BORDERED BY VIETNAM, LAOS, and THAILAND, Cambodia, with a near circular shape, is a perfect example of a compact country. The country can be divided into several physical units: Elephant and Cardamom mountains to the southeast, parts of Annamite Cordillera to the northwest, upper part of the Mekong delta to the southeast, Tonle Sap Lake and its basin to the center and the west and the Mekong River basin between the Cordillera and Tonle Sap. As the Mekong floodwaters rise, there is a reverse (westward) flow into Tonle Sap, which increases the lake depth by over six times. Tonle Sap thus takes up the excess Mekong waters during the monsoon. Thereafter, the lake water resumes its normal eastward flow to Mekong.

Three distinct cultural-historical core regions (Funan, Angkor, and Phnom Penh) can be identified in Cambodia, stretching over a period of 2,000 years. Funan's (1st to 7th centuries) capital was on the Mekong Delta at Vyadhapura (Banam). The Funan society and political system were highly influenced by Indian conquests. The Khmers established a powerful core area based in the Angkor area (802–1432). The Khmer kingship gave rise to one of the most powerful and long-lasting theocratic states in the world and determined not only the dynastic lineage but also the political, social, economic, and agricultural features of the land. Productivity of the land and the belief of the people in a god-king were at the roots of Angkor's power base. The demise of the Angkor core may be at-



tributed to loss of agricultural surplus, depopulation due to malaria, and army weakness.

After the fall and disappearance of Angkor, Phnom Penh emerged as a core region ruled by different rulers. French occupation of Cambodia lasted 90 years (1863–1953). The country got its independence in 1953 and had a stable government between 1953 and 1969 under the leadership of Prince Sihanouk, who abdicated his throne in 1955 and organized state elections for the first time in Cambodian history. After the coup d'état staged in 1970 by his prime minister, Lon Nol, Cambodia came under military rule.

### KHMER ROUGE

The Khmer Rouge (Communist Party) led by Maoist premier Pol Pot displaced Lon Nol in 1975. Khmer Rouge considered cities to be parasites living on agricultural surplus. Thousands of city dwellers were driven out to villages in order to increase rice production. Phnom Penh's population was reduced to 200,000 from 2,000,000 in 1976. Formal schooling was abandoned. Religion was virtually abolished, while pagodas were converted into storage and military places. In the process, 1 million people died between 1975 and 1978.

In 1991, a Cambodian peace agreement was signed. The new government established rights to freedom of political beliefs, assembly, and publication and a market-based economy. However, Cambodia remains troubled by unrelenting political volatility and insurgence. Cambodia is one of the poorest countries of the world. Population growth has been uneven because of political and social events. The infant mortality rate (76 per 1,000) is high, and a large proportion of the population (39 percent) is under 15. Presently, population growth is slow (1.8 percent annually) due to the AIDS epidemic; 170,000 persons lived with HIV/AIDS in 2001. Cambodia is essentially a rice-growing agricultural country with 80 percent of its labor force engaged in agriculture. Only 20 percent of its GDP is derived from industries that include garment making, rice milling, wood products, and rubber. Tourism is the country's fastest-growing industry.

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## Cameroon

**Map Page** 1115 **Area** 183,569 square mi (475,440 square km) **Population** 15,456,000 **Capital** Yaoundé **Highest Point** 13,435 ft (4,095 m) **Lowest Point** 0 m **GDP per capita** \$2,100 **Primary Natural Resources** petroleum, bauxite, iron ore, timber



**CAMEROON IS A** triangle-shaped nation slightly larger than CALIFORNIA. It is wedged between NIGERIA and EQUATORIAL GUINEA on Africa's west-central Atlantic coast at the Bight of Biafra.

The country has varied terrain with western mountains, northern grasslands, and tropical lowlands in the south. Forests line the Atlantic coast. Grassy savannas stretch northeast to marshes on Lake CHAD. To the east is the CENTRAL AFRICAN REPUBLIC. To the south are GABON and CONGO.

Tourism is limited, but recreational areas include beaches near Kribi and abundant wildlife within the national parks, particularly herds of elephants protected in Waza National Park. Archaeologists' findings of stone tools and rock carvings indicate that prehistoric peoples preceded the Bantu speakers who first came to the northern highlands about 2,000 years ago. A state called Kanem existed during the 8th century and included parts of present-day Cameroon. Today, the population includes pygmy tribes and 200 different ethnic groups from 24 different language groups and 80 distinct dialects. The largest tribes are Bamileke (30 percent) and Fulani (7 percent). The predominant religions are animist (51 percent), Christianity (33 percent), and Islam (16 percent).

The country's name comes from the Portuguese word for shrimp after European explorers in the 1400s who found small crayfish that looked like shrimp in the Wouri River. Slave trading flourished from the 15th century well into the mid-1800s; thousands died fight-



ing slave raiders or suffering from cruel conditions en route to the Western and Arabic worlds, where they were forced into unpaid labor and considered owned property.

In 1858, British missionaries established the first permanent European settlement in Cameroon, the town of Victoria at the base of Mount Cameroon. The UNITED KINGDOM, FRANCE, and GERMANY struggled for control during the 1800s, then in 1884 two tribal chiefs signed a treaty that made Cameroon a German protectorate until 1916. Under terms of the World War I Armistice, France and Britain divided the territory and later received League of Nations mandates, then United Nations trusteeships. Both pledged in 1946 to grant self-governance. French Cameroon became independent on January 1, 1960. In February 1961, British Cameroons voters in the north chose to merge with Nigeria, while voters in the south chose Cameroon.

Cameroon is divided into 10 provinces, each headed by a governor appointed by the president, who as head of state holds the most governmental power and is elected to a seven-year term. In the National Assembly, 180 legislators are elected to five-year terms. Cameroon's chief political party is the Cameroon People's Democratic Movement and was the only party allowed until 1991.

Coffee, cocoa, cotton, rubber, bananas, livestock, and timber are Cameroon's major products, but petroleum is the primary export.

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## Canada

**Map Page** 1135 **Area** 3,850,000 square mi (9,984,670 square km) **Capital** Ottawa **Population** 32,207,113 **Highest Point** 19,550 ft (5,959 m) **Lowest Point** 0 m **GDP per capita** \$29,800 **Primary Natural Resources** iron ore, nickel, zinc, copper, gold.



CANADA ENCOMPASSES the second-largest land area of any country after RUSSIA. Like its southern neighbor, the UNITED STATES, Canada's terrain varies quite dramatically and is divided into multiple geographical areas.

The CANADIAN SHIELD, which is the largest geographical area, encompasses half the country and centers on Hudson Bay. This horseshoe-shaped region reaches northward from the U.S. border and covers the area from the Gulf of St. Lawrence in the east, south to the Great Lakes, and west to the Great Slave Lake in the province of Vancouver. The Canadian Shield was carved during the last Ice Age, when glaciers moved across the land, scraping away the soil, damming rivers, and creating lakes. Its rivers are the heart of Canada's hydropower industry.

The southeastern region of Canada consists of lowlands, bordered by the Great Lakes: Lake MICHIGAN, Lake SUPERIOR, Lake ERIE, and Lake ONTARIO. It is segmented by the ST. LAWRENCE RIVER, which is an important shipping lane. The St. Lawrence River flows downward toward the ocean from the Great Lakes, which are above sea level. A series of locks help to move the ships upstream. Montreal sits at what is the head of navigation on the river, the point at which the ships can go no further due to rapids or waterfalls.

### ERODED MOUNTAINS

Further north and east, the APPALACHIAN MOUNTAINS extend north from the United States. This mountain range is a chain of older, well-eroded mountains that were created by glacial activity. The eastern region of Canada is heavily forested. The tree line or boreal forest consists of coniferous (evergreen) trees and extends across the Ungava Peninsula to the lower Mackenzie Valley and ALASKA. North of this area, the poor soil quality supports little vegetation beyond hardy, shallow-rooted tundra plants such as lichens and mosses. Because of the cold temperatures, the soil below the top layer of soil is permanently frozen and does not thaw even in the summer months.

South-central Canada consists of rich, flat farmland and lakes. To the west, the plains give way to PLATEAUS and river channels that were carved by glacial activity during the last Ice Age. Western Canada is home to the Canadian Cordillera, a system of rugged mountains that include the St. Elias, Mackenzie, and Rocky Mountain ranges.

Canada's highest mountain, Mount Logan (19,550 ft or 5,959 m), is a part of the St. Elias Mountain Range. The western coast consists of dense forests and moun-



*Vancouver, British Columbia, is Canada's major metropolis on the Pacific Ocean coast.*

tains that are the source for three of Canada's major rivers: the Columbia, the Yukon, and the Fraser. These rivers serve as important parts of Canada's hydropower industry. The western port of Vancouver, Canada's third-largest city, serves as Canada's main port for the exportation of wheat, coal, and lumber to Asia.

Northern Canada consists largely of year-round permafrost and frozen tundra. Due to the extreme temperatures in the winter, less than 1 percent of Canada's population lives in the northern territories and many who live in the north are Inuit Amerindian.

## CLIMATE

Canada has four distinctive seasons. The timing of each of these seasons changes, according to latitude. The Canadian CLIMATE is subarctic throughout most of the country. On average, temperatures are cool in the summer and sub-freezing during the winter, with the average temperature hanging below 0 degrees F and C. In northern Canada, winter begins in August and runs through March, and daylight is extremely limited. In the Arctic regions of northern Canada, there is no sunlight for six months of the year.

In the southern part of the country, summers and winters are much more temperate. Temperatures can reach the lower 80s F (upper 20s C) during the summers. The mildest winters occur in the southeast and along the western coast.

The east and west coasts tend to be wet year-round, and the western coast experiences heavy seasonal rains during the winter months. The movement of air across

the plains to the Canadian ROCKY MOUNTAINS causes air flow patterns that can produce cyclic storms to the east of the mountains during the winter. The Canadian Central Plains themselves are generally quite arid year-round, although thunderstorms mitigate some of the dryness during the summer.

## ENVIRONMENT

Canada's mining industries, as well as coal-burning and vehicle emissions, have caused significant problems with air pollution, water contamination in the oceans, and acid rain. The country is also prone to several environmental hazards. The west coast of Canada (mostly British Columbia), is a part of the Pacific Rim, or RING OF FIRE.

The Ring of Fire is marked by its unusual number of volcanoes. The west coast of the Canadian province of British Columbia and the southern part of the Yukon include many volcanoes. There have been no recent eruptions, but many of these volcanoes remain active today. Due to its location along the Ring of Fire, Canada's western coast is also vulnerable to tsunami activity, which may result from seismic or volcanic activity elsewhere in the Pacific.

Canada also records approximately 9,000 forest fires throughout the country every summer. Most of these fires are caused by lightning strikes.

## GOVERNMENT

The seat of the Canadian national government is located in Ottawa, a city that is situated in the southern part of the province of Ontario. Canada is sub-divided into 10 administrative provinces (the capitals are in parentheses): Newfoundland (St. John's), Nova Scotia (Halifax), New Brunswick (Fredericton), Prince Edward Island (Charlottetown), Quebec (Montreal), Alberta (Edmonton), Saskatchewan (Regina), British Columbia (Victoria), Ontario (Toronto), and Manitoba (Winnipeg). Provincial governments mirror the national government. Their responsibilities include civil law, local taxation, land management, local trade, health, welfare, and education.

Newfoundland, Prince Edward Island, Nova Scotia and New Brunswick, which are all peninsulas, make up what is known as the Atlantic Provinces. Halifax is the largest city, and serves as an important port, as it remains free of ice year-round, making it easily accessible to ships in the winter, when many other ports are iced in. The bulk of the population of the Atlantic Provinces lives along the coast, and many make their livelihoods from the sea.

Since the 1960s, there has been a separatist movement within Quebec, where the majority of the population is of French ancestry rather than the Anglican ancestry shared by most of the population. Thus far, any attempts to secede from Canada have proven unsuccessful. In addition to its 10 administrative provinces, Canada has three dependent territories. The Yukon and Northwest territories, which are very sparsely populated, are administered by the federal government. Nunavut became the newest territory of Canada on April 1, 1999, when the Northwest Territories was divided into two parts. The part to the east of the dividing line became Nunavut, whereas the part to the west became a new territory that retained the name Northwest Territories.

## ECONOMY

The Canadian economy is heavily dependent on trade, particularly with the United States. The NORTH AMERICAN FREE TRADE AGREEMENT (NAFTA) has permitted relatively unrestricted trade between Canada, the United States, and MEXICO. Dominant industries include mining, forestry, agriculture, and fishing. Most of the agriculture occurs in the southern part of the country, because of short growing seasons further north. Wheat is the most predominant cash crop, although corn, soybeans, and tobacco are also significant crops. In the western prairies, most agriculture consists of raising livestock, particularly sheep, cattle, and pigs.

Most of the fishing industry is centered along the east coast, around Labrador. However, there is some salmon fishing in the west. Also in the west, British Columbia is home to Canada's forest industry, where there is significant production of wood pulp and paper. The western part of the country is also home to Canada's primary mineral resources: oil, gas, and coal. Further east and north, the mining industry is focused on zinc, iron, nickel, copper, lead, uranium, and potash.

## HISTORY

Like most of North America, Canada's first settlers are generally believed to have arrived across the Bering Strait from SIBERIA via a now-defunct land bridge approximately 10,000 to 30,000 years ago and disseminated throughout the continent. A second wave of settlers, who are the ancestors of the Inuit people, arrived around 4000 B.C.E.

The Vikings were the first Europeans to reach Canada, most notably Leif Eriksson and Thorfinn Karlsefni around 1000 C.E. The Vikings did not stay however, and the next Europeans did not arrive until



*Banff, Alberta, is one of Canada's several cities located in the country's isolated and vast northward interior.*

Italian navigator John Cabot's expedition landed at Newfoundland in 1497. By the 16th century, French and English explorers, including Jacques Cartier and Samuel de Champlain, arrived and began to explore Canada's interior. Cartier gave Canada its name, following a misunderstanding regarding the Iroquois word for "village." When Cartier asked the Iroquois the name of his location, they answered "Kanata." Cartier and the other explorers who were with him began to refer to that location (now Quebec City) as "Kanata," anglicizing it to "Canada."

Canada remained a subject of exploration for those who hoped to find a northwest passage between the Atlantic and Pacific Oceans that might facilitate trade between Europe and Asia. Henry Hudson, who led the ship *Discovery* in 1610, was one of the earliest explorers who sought such a passage. Although Hudson was unsuccessful, his quest did lead to a charter to be commissioned by King Charles II of England in 1670. This charter granted Prince Rupert and 17 other men sole trading rights on all lands whose rivers drained into Hudson Bay, an area that encompassed nearly 40 percent of Canada. Rupert and the other men became known as the Governor and Company of Adventurers Trading into Hudson Bay. They are considered to be the first governors of the English colony. This early federal state included portions of what are now the Canadian provinces of Quebec, Nova Scotia, and New Brunswick.

The settlement of Canada occurred first in the east, along the Atlantic coast and Hudson Bay area. The French quickly colonized the region around the St.



Lawrence River and the Great Lakes between Quebec and Montreal. The French settlers began a thriving fur trade, although conflicts over settlement rights grew between the French and English settlers. These conflicts culminated in the capture of Quebec and Montreal by British General James Wolfe. The tension was resolved, at least temporarily, by a treaty that was signed in Paris in 1763 that turned the lands over to the British.

Canada became even more of a British stronghold during the years of the American Revolutionary War, when British loyalists fled to Canada. Two distinct colonies, Upper and Lower Canada, were created by a constitutional act in 1791. Dissension led to an unsuccessful revolt in 1837, although political reform resulted, including the fusion of the two colonies.

In 1845, a second famous attempt to find a northwestern passage took place. Englishman Sir John Franklin took 128 men and two ships, the *Terror* and the *Erebus*. Franklin's mission was commissioned by Sir John Barrow, England's Secretary of the Admiralty. Franklin and crew were directed to sail through Lancaster Sound and Barrow Strait and to get as close as possible to the Bering Strait by traveling southwest. Franklin and company were last seen on July 26, 1845. By 1848, when no word had been received from the expedition, a small rescue mission of three teams was dispatched to search for them. None of the three teams was successful and neither Franklin nor any members of his crew was ever seen or heard from again.

The gold rushes of the 19th century served as important catalysts in the interest, acquisition, and settlement of what is now western Canada. Canada gained territory in the west in 1849, with the creation of the colony of Victoria, which is located on the island of Vancouver, off the coast of British Columbia. Canada expanded again in 1858 as the result of the gold rush, and British Columbia was added to the growing British colony. During this time period, Canada experienced an increasing population, including an influx of immigrants from other European countries, including Russia.

Until the cessation of slavery, Canada also served as a refuge for African-Americans who had escaped from slavery in the southern United States. Canada officially became the Dominion of Canada in 1867, under the British North America Act. The provinces of Quebec, Ontario, Nova Scotia, and New Brunswick were all added at this time.

A second gold rush occurred in the late 19th century, known as the Klondike Rush. Prospectors who

had been working in the region of modern-day San Francisco, heard rumors of gold being discovered in the Yukon Territory. Thousands of would-be miners came pouring into the sleepy lumber mill town of Dawson City, which had been founded near the junctions of the Yukon and Klondike rivers by Joseph Ladue in 1896 and named after George M. Dawson, who had led a geographic survey of the Northwest Territories in 1887. The area remained busy with prospecting activities for approximately three years, after which the prospectors moved on when gold was discovered in Nome, ALASKA.

The later half of the 19th and early 20th century proved to be a time of accelerated geographic expansion for Canada. Although some of the expansions and geographic changes involved the redrawing of boundaries of existing western and eastern settlements, much of the expansion included additional territories in the northwest as well as the acquisition of lands that are now a part of central Canada. The government purchased the Northwest Territories from the Hudson Bay Companies in 1870. In the next 35 years, Manitoba (1870), Prince Edward Island (1873), the Yukon Territory (1898), and Saskatchewan and Alberta (both 1905) all joined the Dominion.

As in the United States, the geographic expansion of the European settlers proved to be problematic for the native peoples. Settlers encroached on native lands and destroyed the bison, which were an important food source and resource. Tensions flared and culminated in an armed uprising in the later half of the 19th century by the Métis, who were of French and native ancestry. The uprising was unsuccessful and Louis Riel, who led the uprising, was executed in 1885.

Britain granted increase autonomy to the Dominion in 1931, in recognition of its support for the Allies during World War I. Twenty-one years later, in 1982, Canada gained full control of its constitution. The Canadian Constitution replaced the British North America Act and guarantees such rights as freedom of religion, speech, association, and the press. Canada has remained geographically stable since this time.

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## Canadian Shield

THE CANADIAN or Laurentian Shield, the largest natural region of North America at 1.1 million square mi (3 million square km), is located north of the St. Lawrence Lowland and east of the Interior Plains. It is composed of igneous and metamorphic rock of Precambrian origin, some of the oldest rock on Earth. More than 80 percent of the surface is exposed gneissic granite, basement rock at the surface, the product of intense glacial action and erosion over the past half billion years. Glacier ice scoured the rock and sculpted river valleys, dragged and laid down boulders called erratics, and severely disrupted the surface drainage pattern. The shield is largely devoid of soil and dotted by hundreds of thousands of swamps, lakes, rivers, and streams. The shield is stable continental crust gently rolling in character (under 2,000 ft or 600 m) with occasional prominent uplifts of crustal blocks. One sees the sharpest local relief along the southern edge, especially the Laurentide Escarpment in Quebec. The shield exhibits a bowl shape as it slopes gently northward to Hudson Bay. Glacial debris has been deposited in river valleys and lowlands to considerable depths, such as around James Bay and Hudson Bay, giving the landscapes a notable flatness.

Long, cold winters and short, cool summers characterize the region. Though primarily rock, water, and ice, the shield also hosts a vast boreal or softwood forest of spruce, fir, pines, and tamaracks, tall and dense in the south to short and sparse in the north. Soils are poorly drained, acidic, and thin, and therefore of limited value to agriculture. These soils are mainly spodosols, associated with evergreen forest, while the northern TUNDRA soils are heavily moisture laden and frozen for much of the year. Fertile soils are limited to a few river valleys where deposition has been significant.

The shield effectively divided eastern and western CANADA and posed a major barrier to westward migration. The Hudson's Bay Company created a trade monopoly across the region and laid the basis for a

network of extractive industries. Settlements today are mostly small, widely dispersed, have narrowly based economies based on extractive industries such as mining, and are controlled largely by the urban-industrial core to the south. Sudbury, Ontario, at 160,500 is the largest metropolitan center in the region, followed by Thunder Bay, Ontario, at 125,000.

Inuit and native populations are well represented on the shield, although in scattered locations, and the population in general faces limited economic opportunities, unemployment, and related social problems. The shield has figured prominently in the development of Canadian character and culture, as evidenced in everything from art and music to the stories of Jack London.

Metallic ores are concentrated in an arc between the North ATLANTIC OCEAN, ST. LAWRENCE RIVER, and the Arctic as, for example, nickel at Sudbury, copper-lead-zinc at Flin Flon, and iron ore on the Quebec-Labrador border and in western Ontario. Access is a critical issue, especially for extractive industries like mining and lumbering that depend heavily on overland transport. Construction costs are high over vast distances of rocky, ill-drained surfaces where population densities are low. Railroad lines extend from the Prairie Provinces to Churchill on Hudson Bay as well as to mining developments on the Great Slave Lake, Northwest Territories, and to James Bay in Quebec. Helicopter and small plane services are integral to the region. All in all, transportation networks are not well developed, and communities face ongoing problems of isolation, high costs, and uneven integration into the Canadian economy.

The shield holds great hydroelectric potential, especially along its southern edge where local relief is most abrupt. Power stations at Churchill Falls, Labrador, and James Bay, Quebec, are the shield's two largest hydroelectric developments. Power is abundant, sold to markets in the northeastern UNITED STATES, and important as cheap energy for aluminum manufacturing, lumber processing, and other shield industries. Intimate functional relationships have grown up between the resource areas of the shield and the processing industries of the St. Lawrence Valley. Tourism is a fast-developing industry, especially on the southern margins, and is accompanied by growing public concern over preservation of the fragile shield environment.

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## Canary Islands

THE CANARY ISLANDS lie just 93 mi (150 km) off the northwest coast of Africa in the ATLANTIC OCEAN but have been politically and culturally attached to SPAIN, 830 mi (1,350 km) to the northeast, since the 14th century. Today the seven islands, an autonomous region of Spain, are among the most popular holiday destinations for tourists from northern Europe.

The islands' proximity to Africa is apparent in their climate, an extension of the deserts of the SAHARA. Some areas are semiarid, with abundant cacti and *maspalomas* (large sand dunes), while higher elevations host laurel and pine forests, with subtropical and tropical plants in the valleys in between. The islands are volcanic in origin and reflect this in their steep inclines and rugged cliffs. They vary in age and volcanic activity, from the oldest, Fuerteventura and Lanzarote in the east, to the most recently formed La Palma and El Hierro, furthest west in the chain. La Palma has seven volcanoes that have erupted since the 15th century, most recently Teneguía, in 1971. It also has a large collapsed caldera in the center of the island (Taburiente), with a rim averaging 6,600 ft (2,000 m) in height and an astronomical observatory.

Between these extremes of old and new islands at the eastern and western ends of the chain, lie the largest and most populated of the Canary Islands, Tenerife and Gran Canaria. Most of the beach resorts and nightclubs are on these two islands, but they too have their share of scenic ravines and mountain peaks—Pico del Teide is the highest point not only in the Canary Islands, but in all of Spain. Lastly, the small island of La Gomera, where isolation has best preserved the indigenous culture of the Guanches people, including their distinctive pottery made without a wheel, and the famous whistling language, Silbo, used by shepherds to communicate between sharp valleys and cliffs for centuries.

The Guanches are believed to be immigrants from North Africa, but legends name them as the only sur-

vivors of the lost continent of Atlantis. The ancient Greeks knew of the islands, as the last known land after the Pillars of Hercules (the Straits of Gibraltar). They were known as “the Happy Isles” before cartographers started calling them the Canaries—possibly due to the large hunting dogs (*canis* in Latin), still bred on the islands today (called *verdinós* or *bardinós*). But little was known about the islands until they were visited by a Genoese explorer, Lancelotto Malocello in 1312 (giving his name to Lanzarote). Ancient mariners drew the first meridian at El Hierro, marking the western edge of the world (today this is the west 18th).

Spanish monarchs established control over all of the islands between 1402 and 1504 and resisted repeated attempts by the Dutch and English to take the islands. The islands were coveted as the important last stop before setting off to cross the Atlantic, starting with Columbus himself, who last saw land at La Gomera on September 6, 1492. The islands formed two provinces, Santa Cruz de Tenerife and Las Palmas, until the reorganization of Spain into regions in 1984, which made the Canaries one region, with relative internal autonomy. Less than 10 percent of the gross domestic product is generated by agriculture, mostly bananas, especially on Tenerife, but also figs, grapes, and almonds in areas with a more Mediterranean climate. Rather, it is tourism—over four million visitors a year come to Tenerife alone—that contributes most to the local economy and provides residents with a per capita income higher than that of mainland Spain.

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## canyon

A CANYON IS A deep, narrow passage cut through the surface of the Earth with steep cliffs on both sides. Sometimes called a gorge or ravine, canyons are often formed in mountainous, arid, or semiarid regions where riparian EROSION is much greater than erosion from general weathering. They range in size from an arroyo, or ditch, to the GRAND CANYON, with its depth of more than a mile. Canyons can be found all over the world, at the bottom of the ocean, and even on other

planets. The word *canyon* is thought to originate in the Spanish *cañon*, which means “tube” (from the Latin *canna*, a reed). This root is descriptively accurate because canyons are frequently in the shape of a tube, having been carved by the constant flow of water between surrounding walls.

Canyons are formed and deepened by erosion from moving water and may be widened by landslides. A number of canyons were carved out of the Earth by massive glaciers, some more than a mile thick, which took millions of years to cut their way through solid stone. As the surface of the Earth has been shaped by climate over eons, cycles of ice age followed by thaw have occurred, and much land that is desert today was under water at some time, submerged below ancient seas.

These ancient seas deposited sediments, which settled in layers, and nowhere are those layers more evident than in the walls of a canyon. As snows melt and collect in rivers, the force of water slowly carves channels through these layers, exposing the history of the land in a sedimentary cross-section of Earth. These exposed layers offer an excellent living laboratory for scientists to study the geological changes in the Earth's crust. For example, at the Grand Canyon's rim, the Earth is only 250 million years old in places; on the floor of the canyon, the most ancient layers are thought to be up to 1,200 million years old.

As rivers erode deep into the canyon floor, they become entrenched and cannot easily alter their course, thereby deepening themselves further, faster. These rivers become deeper and canyon walls become higher and higher. The Grand Canyon slices through the Earth's crust for 217 mi (347 km) miles from beginning to end. It averages 10 mi (16 km) across—almost 20 mi (32 km) at some spots—and over 1 mi (1.6 km) deep. The Snake River and its Hells Canyon are another example of river entrenchment; while such canyons are massive, they are not the biggest on Earth. That honor goes to the canyons that form on the ocean floor, called submarine canyons.

Submarine canyons, forged by some of the same forces as canyons above sea level, dwarf the Grand Canyon in magnitude. The force of rivers emptying into the ocean, massive underwater landslides, and mudflows combine to carve out submarine canyons. One of the largest of these canyons, the Great Bahamas Canyon or Trench, measures 14,000 ft (4,575 m) from rim to floor; that's twice as deep as the Grand Canyon.

As impressive as these numbers are, the biggest canyons in the solar system are not found on Earth. On

the planet Mars, the Valles Marineris canyon system spans over 2,500 mi (4,000 km) from end to end—about the distance from New York to San Francisco—and has a depth of up to 6.25 mi (10 km). Scientists are interested in canyons on Mars because they may indicate the presence of water at some time in the planet's history, and the presence of water on Mars—confirmed by NASA's 2004 robotic-lander mission to the Red Planet—indicates the possible presence of life.

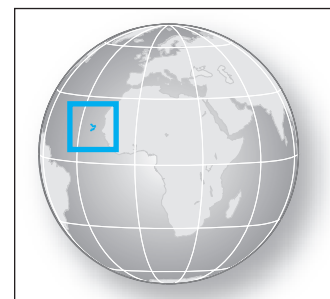
Canyons are important for many reasons. Their striking beauty and the diverse flora and fauna that flourish there enrich the landscape and the lives of the people who experience them. They can provide information about climate changes in the past and may help predict climate changes in the future. They are also important to archaeologists because of the artwork and fossils found on canyon walls, and the cliff dwellings built in the steep walls of some canyons can teach us about ancient cultures.

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## Cape Verde

**Map Page** 1113 **Area** 1,557 square mi (4,033 square km) **Population** 412,137 **Capital** Praia **Highest Point** Mt. Fogo 9,281 ft (2,829 m) **Lowest Point** 0 m **GDP per capita** \$1,400 **Primary Natural Resources** salt, basalt, limestone, kaolin, fish.



CAPE VERDE IS a volcanically produced archipelago, consisting of 10 major islands and five islets in the ATLANTIC OCEAN, 285 mi (460 km) off the coast of SENE-

GAL in Africa. Settled by the Portuguese sometime between 1455 to 1461, the uninhabited and resource-poor Cape Verdes offered an early lesson in what today's marketing gurus refer to as: "location, location, location." The craggy islands, with their hot, dry climate, were of little intrinsic value. Rain came sporadically, but sometimes in torrents, ruining whatever crops might otherwise grow.

Trade winds swept early sail-powered vessels to Cape Verde, and PORTUGAL capitalized, vigorously, on the islands' location. Descending from north to south, the AZORES, Madeiras, and Cape Verde formed strategically positioned stepping-stones to and from the Atlantic for Portugal. Their natural and manufactured resources were collectively leveraged for the Crown, and also offered an African trade axis with its own cultural and economic attributes.

Portugal carefully planned its colonial economies. Goats, which could survive virtually any terrain, were brought to Cape Verde even before settlers. A preservative and dietary supplement for long transoceanic voyages, salt proved to be the only redeemable natural resource. The Portuguese also envisioned Cape Verde as a trade outlet for their naval stores, but proximity to the African coast rendered slave-trading the largest commercial activity, peaking in the first half of the 17th century and ending in the early 19th, when most of the world outlawed it. In order to settle the islands and bolster their profitability, the Portuguese crown initially extended trade privileges to private firms and issued land grants with the hope of seeding plantation-style agriculture. (Farming largely failed. Ironically, some of the best-growing crops, notably beans and squashes, were New World imports.)

Less privileged individuals arrived at Cape Verde, too: Former prisoners brought at government behest for their labor; Iberian Jews fleeing the Inquisition; independent adventurers of truly diverse nationalities; slaves and freed slaves (often liberated during times of extreme drought/famine when even wealthy Cape Verdeans could not provide for them); and their well-mixed progeny.

The early elite profited from government-granted status, but others were forbidden to trade with foreign countries and limited in what they could exchange (no guns to Africa, for example). They frequently flouted colonial dictates and embarked on their own trade, sometimes through smuggling. Generally, they learned to navigate—both commercially and culturally—the African coast with its myriad tribal leaderships. Three major trade classes subsequently emerged: *tangomaus*,

originally black African traders who adapted to Portuguese culture; *lancados*, white Portuguese who ventured from Cape Verde to Africa; and *grumetes*, black or mixed-race servants who worked the boats and hauled cargo.

With the end of slave trading, Cape Verde returned to provisioning. Faster, more efficient steam ships plied the seas, and newly discovered coal and a good harbor at Mindelo (San Vicente Island) fueled the economy. Combined with poor conditions at home, increasing cosmopolitanism for the first time encouraged a major exodus: Seafarers from the island of Brava joined western-bound whaling crews and, subsequently settled in RHODE ISLAND, CALIFORNIA, and primarily MASSACHUSETTS.

Cape Verde achieved recognition as a geocultural "broker" in the 20th century. In addition to building transportation facilities, Portugal established the islands as an educational center for its African colonies, with a seminary and secondary school. But the pervasive anticolonial movement sweeping the continent similarly inspired Cape Verdeans toward independence in 1975. All told, the islands' geographic position yielded a maritime economy descended from the Age of Exploration, and a unique Afro-Portuguese Crioulo (creole) culture that became better defined with the dissolution of colonialism.

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## capitals

A CAPITAL IS A CITY or town that serves as the administrative center of a political unit such as a country, state, or province. The word *capital* is ultimately derived from the Latin word for "head" (*caput*). Capitals of counties in the UNITED STATES are generally known as "county seats"; in England and IRELAND such capitals are called "county towns." The term *capital* is sometimes used in a promotional sense to refer to an impor-



tant product closely associated with a particular city or town. For example, Gilroy, CALIFORNIA claims to be the “Garlic Capital of the World,” while Farmington, MAINE is the “Earmuff Capital of the World.” Most political units have a single capital city, but several cases of multiple capitals do occur. BOLIVIA’s constitutional and judicial capital is Sucre, while La Paz serves as the administrative capital. The legal capital of the NETHERLANDS is Amsterdam, although The Hague functions as the governmental center. SOUTH AFRICA maintains three capitals: Pretoria (the administrative capital), Bloemfontaine (the judicial capital), and Cape Town (the legislative capital). Two U.S. states once maintained dual capitals. CONNECTICUT’s capitals were New Haven and Hartford; in the interest of efficiency, Hartford was made the sole capital in 1875. RHODE ISLAND’s capitals were Newport and Providence; Providence has been the sole capital since 1900.

Geographers sometimes distinguish between “natural” capitals and “artificial” capitals. Examples of natural capitals would be LONDON, PARIS, and MEXICO CITY, cities that dominate their countries. Historically, it was often the case that the country, or the nation, took shape from these natural capital cities outward. Artificial capitals are those that were founded by their political units specifically to serve as capitals. Examples include Canberra in AUSTRALIA, Brasilia in BRAZIL, and recently Abuja in NIGERIA and Dodoma in TANZANIA. The distinction between natural and artificial capitals is not a precise one, as all capitals were at one time chosen to fill that role. Paris, for example, became the permanent capital of FRANCE in the year 987 when Hugh Capet, who had been Count of Paris, assumed the French throne.

Many capitals have been chosen because of the perceived advantages of their location. Some governmental units have placed their capital cities at the center of their area, or perhaps at the center of their population. Indianapolis and Springfield were chosen as capitals of INDIANA and ILLINOIS in the early 19th century because those cities were located near the geographic centers of their respective states. Since the northern portions of WISCONSIN and MICHIGAN were and are relatively unpopulated, Madison and Lansing lie much nearer to the center of population of their respective states than to the geographic center. Occasionally, though, a political unit will place its capital in a city perceived to be near the center of population, only to have the center of population shift radically over time. Examples include Sacramento, California, which was chosen as the capital in 1854 at a point midway between San Fran-

cisco and the goldfields of the Sierra Nevada. Today, with the largest part of California’s population located far to the south, Sacramento is an eccentric capital. FLORIDA continues to maintain its capital at Tallahassee, midway between the state’s major early 19th-century population centers, Pensacola and St. Augustine. Now, with the largest part of Florida’s population living in southern Florida, Tallahassee has become an off-center capital. Lying roughly midway between Australia’s two dominant cities, Canberra was chosen as the national capital following Australia’s unification in 1901, since neither Melbourne nor Sydney would allow the national capital’s functions to go to the rival city.

Other capitals have been chosen as compromise locations, balancing competing interests within their political units. Ottawa, for example, lies not only along the border between CANADA’s two largest provinces (Ontario and Quebec), but more importantly alongside the cultural divide between French and English Canada. The early United States government chose Washington, D.C., as the national capital, located at a point neither too far south nor too far north, along the Potomac River on the MARYLAND-VIRGINIA border.

When the American Civil War broke out, Washington found itself precisely on the border between the loyal Union states and the seceding Confederacy. Arlington Memorial Bridge across the Potomac now symbolically re-joins the South to the North, linking the Lincoln Memorial on the north or District of Columbia (D.C.) bank with Arlington House (the home of General Robert E. Lee) on the south or Virginia side.

Historical geographer Vaughan Cornish has argued that expanding states tend to locate their capitals, not in the center of their area or population, but rather off-center, toward their most dynamic frontier. JAPAN, for example, moved its capital northeastward from Kyoto (“capital city”) to Tokyo (“eastern capital”) in 1868 at the same time that the Japanese were expanding their control over the northern half of the Japanese archipelago.

Berlin became the dominant German capital, located toward the frontier where Germans were pushing eastward against Slavic and Baltic peoples. After the American Revolution, the capitals of seven of the original 13 states were transferred away from coastal cities and reestablished in the interior. Incidentally, these seven states—NEW HAMPSHIRE, NEW YORK, PENNSYLVANIA, Virginia, NORTH CAROLINA, SOUTH CAROLINA, and GEORGIA—were precisely those states that possessed an open frontier to their west.

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## Caribbean Sea

THE CARIBBEAN SEA is a suboceanic BASIN in the western ATLANTIC OCEAN. The sea covers just over 1 million square miles (2.6 million square km) and contains numerous islands. The islands, which vary greatly in size, cover some 91,000 square mi (235,688 square km). CUBA is by far the largest at 44,000 square mi (113,959 square km). In contrast, ANGUILLA has a mere 100 square mi (259 square km).

The islands can be divided into four groups. First are the BAHAMAS, consisting of more than 700 small islands. Second are the Greater Antilles, made up of Cuba, Hispaniola, PUERTO RICO, and JAMAICA and comprising more than 80 percent of the total land area of the Caribbean. Third are the Lesser Antilles, comprising two arcs of islands. An inner arc is made up of volcanic islands, while an outer arc is made of coral limestone islands. Fourth are the South American offshore islands of ARUBA, Bonaire, Curaçao, TRINIDAD, and TOBAGO.

Several geographic characteristics define the Caribbean. One is the insular nature of the region. The fact that the region is made up of many small islands has shaped the Caribbean's history. The small size of the islands made it virtually impossible for the native inhabitants to resist European attacks, enslavement, and disease. The large number of islands allowed several European powers to colonize the region beginning in the late 1400s. The presence of various European countries has contributed to the cultural diversity of the Caribbean Sea. Furthermore, because of the fragmentation of the region, there was historically more interaction and contact between the islands and the metropolitan powers than among the islands.

The small size of the islands is a second important feature. While the islands are small, many of them have relatively large populations, making them some of the

most densely populated areas of the Western Hemisphere. The small size of Caribbean nations has led to numerous problems. Land is often scarce and internal markets are small, forcing countries to rely on imports. Per capita government spending in areas such as education, healthcare, and welfare is all extremely high in the Caribbean.

A third defining characteristic is the Caribbean's location in a maritime tropical air mass. Average temperatures in the region are high at around 80 degrees Fahrenheit. There is little seasonal change throughout the Caribbean. Precipitation in the region varies from island to island. Low-lying islands receive very little rainfall, while those with higher volcanic peaks receive more. Precipitation even varies on each island, as the northeastern sides tend to be wetter than the southern sides.

Hurricanes are a fourth characteristic of the Caribbean. They are a regular occurrence in the region, arriving between June and November of each year. The hurricanes form in the eastern Atlantic Ocean and follow the trade winds to the Caribbean, where an average of eight strike each year. Hurricanes are often destructive, damaging property and crops. In 1963, Hurricane Flora took more than 7,000 lives in the Caribbean.

A fifth characteristic is environmental degradation. The introduction of export agriculture in the form of sugarcane production ushered in environmental problems in the Caribbean. As European plantation owners put their African slaves to work clearing forests, native flora and fauna often disappeared. Such deforestation led to problems such as increased risk of erosion and drought. Fertile soil was quickly exhausted. By the 20th century, poverty and tourism both contributed to these environmental problems in the Caribbean.

A sixth feature of the Caribbean is its strategic location. It serves as a link between Europe and Latin America. The Spanish used the Caribbean as a base to conquer the mainland areas of the Americas. Beginning in the late nineteenth century, the UNITED STATES began to become involved in the Caribbean because of its strategic importance. After the opening of the PANAMA CANAL in the early 20th century, the region's strategic significance for military and economic matters greatly increased.

### CARIBBEAN HISTORY

The history of the Caribbean gives the diverse region a sense of common identity. The islands share a common history of conquest, colonization, slavery, and sugar

plantation agriculture. Before the arrival of Europeans in 1492, there were a series of cultural waves from the mainland of the Western Hemisphere to the islands of the Caribbean. Two major indigenous groups populated the region. First were the Arawaks, a largely peaceful group who inhabited the larger islands. Second were the more warlike Caribs, who concentrated on smaller islands.

The period from 1492 until the mid-1600s was one of European conquest and colonization. The Spanish were the first Europeans to settle the Caribbean, concentrating on the island of Hispaniola. They then moved on to other islands such as Jamaica, Cuba, and Puerto Rico in search of gold and slaves. The native population of the Caribbean was unable to withstand this Spanish conquest. Both gold and slaves were quickly exhausted and the Spanish turned to the conquest of the mainland.

By the mid-17th century, other European powers such as the British, French, and Dutch became increasingly involved in the Caribbean. It was in this period that sugar and slavery came to dominate the Caribbean. At this time, the Caribbean more fully became part of the Atlantic economy. British and French colonies such as Barbados, Jamaica, and Saint Domingue became major sugar producers. Large plantations came to dominate the Caribbean landscape. Increasingly, Europeans turned to African slave labor to work these plantations. Of the approximately 10 million African slaves forcibly transported across the Atlantic Ocean between the 15th and 19th centuries, about half went to the Caribbean.

A number of trends have marked Caribbean history since the 1800s. A modern plantation system replaced the slave-based one. Most islands achieved political independence. Many Caribbean nations have since attempted to diversify their economies through industrialization. Since World War II, tourism has come to dominate the region.

## ECONOMY

Overall, the Caribbean economy is small, dependent on trade, and not very diversified. In general, the region produces a limited number of primary products, while importing most of its manufactured goods. Due to its dependence on international trade, the Caribbean often suffers through periods of boom and bust. Unemployment is a major problem that plagues many islands. Much of the region's export earnings must go to service debt, limiting economic growth. Furthermore, the Caribbean is largely dependent on North American

and Europe for markets, technology, investment, and credit. Agriculture in the Caribbean is still important, although it is declining. Soil exhaustion, the high cost of fertilizers and pesticides, and international competition harm the region's agricultural industry. Large plantations produce cash crops for export on many islands. There are also a large number of peasants who produce for local consumption. Caribbean agriculture is often supported through preferential trade agreements, especially with former colonial powers. Sugar remains the key crop in the Caribbean, although its importance is declining as a result of high production costs and world competition. Bananas are another important crop, as they receive preference in many European countries over cheaper Central American bananas. Tobacco and coffee are other significant agricultural products grown in the Caribbean.

The illegal drug trade plays an important role in the Caribbean. Some islands such as Jamaica are important producers of marijuana. Furthermore, narcotics traffickers often ship drugs such as cocaine and heroin through the Caribbean on the way to the United States.

Mineral resources are important on a number of islands. Cuba and the DOMINICAN REPUBLIC produce significant amounts of nickel. Bauxite, needed for the production of aluminum, traditionally was an important raw material in Jamaica, HAITI and the Dominican Republic. Trinidad possesses important oil and gas reserves.

There have been some attempts to industrialize in the Caribbean. Some countries have implemented import substitution industrialization policies in order to produce goods that were once imported. Others have emphasized export-oriented industrialization in order to attract foreign companies. There are numerous small plants in the Caribbean, such as breweries and cement works. Some islands also have important refineries for bauxite, sugarcane, and petroleum.

Since the 1960s, there have been attempts to integrate the economies of the Caribbean. In 1973, 13 former British colonies created the Caribbean Community and Common Market (CARICOM) to improve international bargaining power. Other countries later joined. Overall, CARICOM has had only limited success, although it has established the Caribbean Food Corporation and the West Indies Shipping Company.

Because of its sunny climate and recreational opportunities, tourism has become a major industry throughout the Caribbean. The region has become a popular winter vacation spot for tourists from the

United States, CANADA, and Europe. At about two-thirds of the total travelers, the United States sends the most tourists to the Caribbean, in large part because of the geographic proximity of the region. Ironically, transportation and communication between the Caribbean and the tourists' home countries is better than that among the Caribbean islands.

Before World War II, few U.S. tourists frequented the Bahamas and Cuba. Large-scale tourism in the region began in the 1960s. The governments of most Caribbean islands actively promote tourism, presenting their countries as island paradises. The tourist industry creates jobs and helps the balance of trade in the small Caribbean nations.

There are a number of important problems with the Caribbean tourist industry. Tourism relies heavily on other countries. Difficult economic times in the United States, for example, negatively affect tourism. Bad weather can also adversely influence the industry. While tourism does create jobs, the jobs are generally low-paying ones. Foreign companies, such as cruise lines, often benefit more than the local economy. Large-scale tourism can also harm the environment, straining the water supply and leading to problems of garbage disposal.

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## cartogram

ONE OF THE LIMITATIONS of the traditional paper map is that real world areas with large populations are usually small in physical size and therefore represented as small area units on a map. As such, traditional paper maps have tended to mask geographic patterns in small area units that are of importance and interest on the map. The cartogram was developed to overcome this challenge.

A cartogram is a map or diagram that depicts attributes of geographic objects in direct proportion to the area or length of the objects. In linear cartograms,

the length (distance or travel time) of geographic objects is scaled in proportion to the attribute being mapped. Likewise, in area cartograms, the area of a geographic object is scaled in proportion to an attribute. For example, if an area cartogram uses the area of a country to depict the magnitude of its population (the attribute), then country A, with twice the population of country B, will be represented on a cartogram with an area twice that of country B. Since the cartogram does not represent geographic space, but alters the size of objects in proportion to an attribute, it is not considered a scaled map. As such, the cartogram does not always appear visually similar to a map.

Cartograms are of three types: noncontiguous, contiguous, and Dorling cartograms. Noncontiguous cartograms are the simplest and allow the geographic objects to be detached from their adjacent neighbors. This detachment permits the objects to expand or contract their area without distorting their natural shape. Contiguous cartograms are more difficult to construct because neighboring objects must remain in contact, resulting in a distortion of shape.

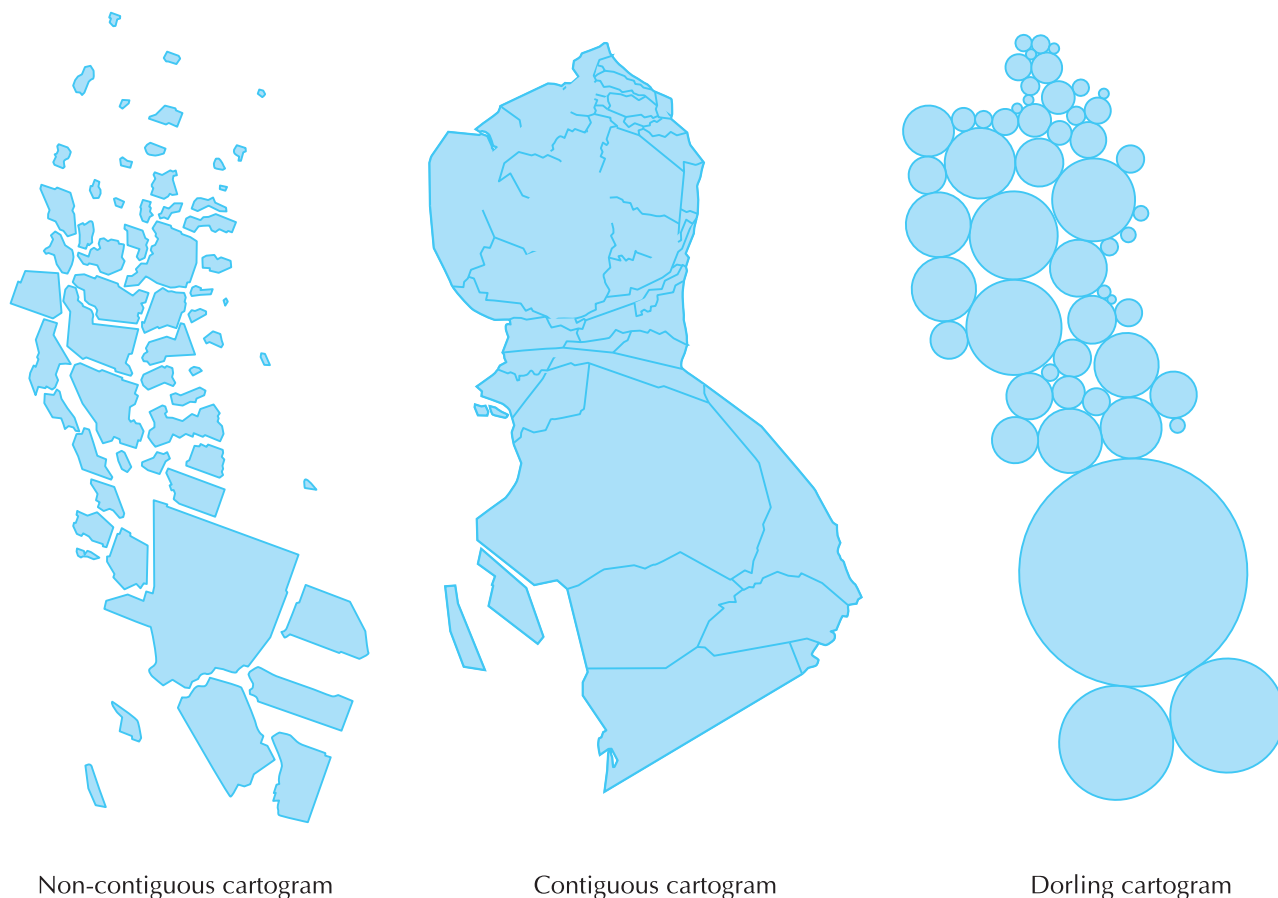
In Dorling cartograms the geographic objects are replaced with a uniform nonoverlapping shape, such as a circle, where the area of the circle is proportional to the attribute being represented. Each cartogram type presents the attribute of geographic objects from a different perspective. Also, each type of cartogram requires a different level of effort from the reader to understand the structure and content of the information being communicated.

In addition to the three pure forms of cartograms, there exist pseudo-cartograms, or false cartograms. Pseudo-cartograms do not strictly follow certain cartogram rules. For example, instead of enlarging or shrinking objects directly, Waldo Tobler pioneered an approach where the distance connections between the objects are transferred to a reference grid such as latitude and longitude to maintain directional accuracy among the objects. But in so doing, extensive errors are created in the real object size. However, pseudo-cartograms are useful because they are regarded as an intermediate stage that is easily created by a computer and can be later modified by a cartographer toward the development of a pure continuous cartogram.

Initially, cartograms were constructed manually using traditional map-making tools and techniques. But this is a tedious and time-consuming process. Today, the cartogram construction process is accomplished predominantly by computer software programs. The usefulness of a cartogram lies in its ability



Three different cartogram forms showing the population of California by county.



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to communicate and visualize data and information. The downside is that each map message will require the creation of a new cartogram, and during the cartogram creation process, data loss is inevitable. However, a well-designed cartogram can communicate information visually and make it much easier for the public and uninitiated reader to understand intended messages. As a scientific tool, cartograms facilitate the visualization and analysis of geographic patterns by clearly emphasizing attributes of interest.

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## cartography

A TERM DERIVED from the word for chart (*charte*) or drawing, cartography is traditionally defined as the art and science of making maps. But over the years, a great deal of theoretical and practical research has been done in all aspects of the subject, including work on map projections, map designs, map visualization, cartograms, terrain models, and the incorporation of new

computer-based technologies such as geographic information system (GIS) data and remote sensing images into the map-making process. These research and technological developments have increased the utility of cartography for services such as geographic data display, storage and analysis, communication, planning, and decision making. At present, the International Cartographic Association defines cartography as the art, science, and technology of making maps, together with their study as scientific documents and works of art.

An understanding of general cartography trends can proceed along two interconnected pathways. In the first pathway, the emphasis is usually on the finished map product together with evaluations about the map functionalities, techniques used, symbology, and aesthetics. In the second pathway, the emphasis is on the data-surveying and compilation aspects of the mapping process. Historical maps and their presentation as graphical objects such as atlases and sheet maps are characteristic of the first “map product” pathway. Later, the integration of information and communication technology (ICT) into mapping and the inevitable data generation and processing consequences have come to define the “data compilation” pathway. In this second pathway, the impact of the mapping process on the map output is the major focus of study.

## THE STUDY OF MAPS

The modern study of maps always originates with a description of how maps work. All maps are about spaces and places that are represented by shape, area, distance, direction, and location in a graphical medium. The surface of the Earth is not a flat plane, so a modification is required to transform the positions of places on the curved earth to the flat sheet of the map so that distortions in shape, area, distance, direction, and location are minimized. This process is called map projection, and the transformation is governed by rigorous mathematical rules.

The projection process takes the lines of latitude and longitude of the round earth and arranges them on a flat plane as a uniform grid. These grids, together with a scale that links the relative linear proportions of the round earth and its representation on the flat plane, allow the map space to be structured so that map properties can be determined to a high level of accuracy. Some examples of projections include the Mercator and Robinson projections.

The scale of the map determines the level of detail that can be shown. Maps of a large scale show more detail with greater accuracy. As the map scale becomes

progressively smaller, larger swaths of geographic areas are shown and so features on the map must be generalized to avoid congestion. The generalization procedure involves stages of simplification, selection, enlargement, displacement, and merging. Simplification involves the progressive collapsing of map features from area to line to point representation as scale decreases. As an example, a lake may be represented as an area at one scale but as a point at a smaller scale. Selection attempts to retain features that are important given the goals and uses of the map. However, some of these important features might not be clearly visible at the desired scale, and so enlargement artificially distorts their dimensions to enhance visibility. Displacement shifts overlapping features so that they become separate elements and more clearly identifiable. Merging aggregates multiple features into simpler ones to correct map overload that can arise from too much detail.

The mapping process also includes the symbolization of the real world using a standardized graphical language. The symbols used have dimensions—point, lines, areas, volumes, and duration—and can be distributed in a discrete, continuous, or sequential manner to communicate feature patterns. Lettering and text labels also form an important part of the feature encoding process. Information about each feature, such as type of road or population, is encoded using variations in nine graphic variables. The graphic variables are size, shape, orientation, color value, color intensity, level of grayness, texture, focus, and arrangement. These graphic variables, together with strict rules for their use, allow the cartographer to encode and distinguish the many features on the spherical real world unto the flat map.

Cartography demands a diverse mixture of scientific and artistic skills to produce effective maps. Cartographers are visually oriented individuals with a talent for communicating with drawings, symbols, and graphics. They attempt to balance rigorous scientific methods with artistic elegance to communicate an accurate, appealing, and easily understandable message through the map medium. However, simply combining all the map elements does not guarantee an effective and aesthetically pleasing map. The challenge then is to understand what constitutes a good map.

A list of qualities that could characterize excellence in statistical graphic designs was proposed by Edward Tufte in 1983. This list was viewed by cartographers as important because if applied to maps it would emphasize the importance of the perceptual qualities of the map design rather than the individual map compo-

nents. Key principles to emerge were that a visual organization of images and a hierarchy should guide the map design between different visual levels. These design principles, together with the artistic abilities of the cartographer, can lead to a balanced, pleasing map.

Computer technology has also influenced cartography in many ways. The use of computer software to automate the map design process has probably been the greatest influence. However, with these improvements in efficiency come new challenges. Selecting the best software for the mapping task and using the software effectively has become one of the main challenges. The proliferation of drawing and illustration software packages has only served to intensify the challenge. Computer literacy is also a cause for concern because many software packages require some knowledge of computer systems operation. Other challenges include paper to digital map conversion accuracies, complexity of data to be presented, output medium, and the future usability of digital data derived from the conversion process.

## GIS AND RS

Geographic information systems (GIS) and remote sensing (RS) have established a beneficial synergy with cartography. Although these technologies have been around since the 1960s, it is only in the last 10 years or so that a stronger link was established with cartography. A GIS is a collection of computer hardware, software, and trained personnel designed to capture, store, manage, manipulate, and communicate data that is spatially referenced. Remote sensing is the gathering of information related to the Earth's surface and does not involve contact with the object under study. RS techniques include aerial photography, radar, and satellite imagery.

Usually remote sensing is accompanied by some "ground truthing," where the researcher visits multiple areas to make sure that the images being received are interpreted correctly. These new digital tools have aided the production of maps. While some maps are still hand-drawn, many more are produced through the analysis of GIS data sets and overlay operations, and digital image processing and classification. Current GIS and RS software now support mapping modules that allow the flexibility and functionality to produce good map products.

Well-known GIS software includes ArcView, ArcGIS, MapInfo, and ArcInfo; ER-Mapper, IDRISI, and ERDAS Imagine are equivalent digital image processing software. An important concept that permeates GIS

and RS software is that of raster and vector data processing capabilities. Raster data store the real world as grid cells where each cell represents some attribute on the Earth's surface. Vector data store the real world as a collection of points, lines and areas. While it is relatively easy to convert between the raster and vector data forms, the cartographic approach has been to select one data form most appropriate for the project goals and to use it consistently throughout the project.

However, despite their advanced functionalities, GIS and RS software still do not yet allow cartographers the flexibility to go beyond the creation of an electronic version of the paper map. This is maybe due to software business strategies that minimize GIS and RS software complexity to maintain broad-based end-user adoption. Ultimately the customization of the final map product is completed by illustration and drawing software packages such as Adobe Illustrator and Macromedia FreeHand. The integration of GIS and RS has provided new ways to visualize data in search for new map patterns and trends that can support analysis and decisions. The role of cartography in the synergy is to guide the development of "good mapping" products for multiple uses and users.

The rapid evolution of the internet and its impact on cartography have been another area of excitement and new opportunities for cartographers. The internet and world wide web (web) are a distributed collection of multimedia information networked together. Access to this information resource is through a browser such as Internet Explorer and Netscape. Of importance to cartographers is the use of the web to enhance, access, and deliver map products. The first wave of enhancements in multimedia cartography improved the static digital map by integrating features such as video, audio clips, and animations to present information in a more integrated manner.

The current wave of enhancements is termed web-GIS, internet-GIS, or web-based mapping and addresses issues such as data democratization and end-user analysis capabilities. The mapping products delivered to end users can range from a simple static digital map to a completely immersive and interactive mapping environment in which to explore and navigate the digital map space. Despite the rapid progress in multimedia cartography and web-GIS, there are still a number of challenges to overcome with the use of the Web in cartography. These challenges are directly related to the data used and incorporate research issues such as standards, interoperability, quality, confidentiality, copyright, and individual privacy.

Today, traditional cartographic principles have been continuously adapted to a variety of user needs and technological changes but still form the core of many digital mapping projects. The Internet holds the key to the continual evolution of cartography. This is so because the Internet integrates both cartographers and noncartographers to communicate, use, and analyze maps, all of which raises awareness of and competence in digital mapping products. The proliferation of digital data on the Internet has also made it relatively easy to produce digital maps.

Students can best prepare for the future of cartography by keeping up to date with new technologies such as GIS, RS, and spatial data analysis. A lack of relevant training in these areas has been cited as the primary source for poor mapping products, especially since software products are now readily making mapping functionalities available but with little or no guidelines for effective map design. Another aspect of relevance to good map design is color choice and selection. While color theory is well developed for paper maps, there is not much systematic knowledge about color choice and use in an electronic medium.

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## Caspian Sea

THE CASPIAN SEA IS ONE of the world's largest bodies of water, situated in a depression between RUSSIA, KAZAKHSTAN, TURKMENISTAN, IRAN, and AZERBAIJAN. It is unique among the world's inland seas in that it is completely isolated from the rest of the global ocean

and has a distinctive continental climate which gives the area extremes in temperature, from very hot summers to very cold winters.

Several rivers flow into the Caspian Sea, most notably the VOLGA and the Ural in the far north and the Terek, Sulak and Kura rivers from Daghestan and the Caucasus to the west. In fact, by including the entire Volga River Basin, the Caspian has the largest catchment area in Europe (1.4 million square mi or 3.5 million square km). But no rivers flow out of the Caspian, and most of the water is lost through evaporation. This is aided by the fact that much of the Caspian is very shallow, particularly in the north and the east. These parts are also very low-lying: The lowest point in Europe is the surface of the Caspian Sea, 89 ft (27 m) below sea level. Most of the eastern coast of the Caspian Sea is dry, with the extreme southeastern corner leading directly onto the Kara Kum Desert. In contrast, the southern and western shores are more steep, culminating in the nearly vertical walls along the southern coast where the ELBURZ and Talysh mountains of Iran come down to the sea. The seafloor drops most dramatically in this region as well, with the Caspian's greatest depths over 3,300 ft (1,000 m). The southwestern areas are also mountainous, consisting of the easternmost reaches of the CAUCASUS mountain ranges.

The Caspian stretches for over 620 mi (1,000 km) from north to south, and between 125 and 250 mi (200 and 400 km) east to west, totaling 143,270 square mi (393,000 square km) in area. It holds much of the world's lacustrine (lake-associated) water: 18,881 cubic mi (78,700 cubic km) of mixed salty and brackish fresh water. The salinity of the Caspian is heavily dependent on the level of flow from the Volga.

### WORLD'S CAVIAR SUPPLY

Sea life in the Caspian has mostly been cut off from other marine populations for millions of years, though recently there has been some colonization of Mediterranean species via the Don-Volga Canal. Most famous of the Caspian fish are its sturgeon (90 percent of the world's catch), prized for their caviar.

The Caspian is also home to large populations of seals, which are also hunted for their furs. The Caspian was the first place to begin marine extraction of oil and is now one of the most carefully examined regions of the world for future potential in oil and natural gas, particularly in the sandy lowlands and the Mangyshlak and Cheleken peninsulas along the eastern coast.

The eastern coast is marked by several deep inlets and bays, most of which are very shallow. When wa-





Most famous of the Caspian fish are its sturgeon (90 percent of the world's catch), prized for their caviar.

ters from these bays evaporate, significant valuable chemical compounds are left behind. The world's largest deposits of sodium sulfates are in the basin of the Kara-Bogaz-Gol Bay in Turkmenistan. This bay is considered the world's largest lagoon, as it is mostly cut off from the main body of water by sand bars.

At the height of the Soviet era, this seal was made complete and the bay completely disappeared (a disappearance of several thousand square kilometers of water). But extraction of chemical compounds was actually made more difficult than envisioned, and since the 1980s, the project has been reversed, and water is returning to Kara-Bogaz-Gol. Soviet Volga dam projects significantly lowered the levels of the Caspian in general from the 1930s to the 1970s, when environmental damage became too great to continue to be ignored. The Caspian also suffers from pollution, primarily close to industrial centers and oil refineries along the Apsheron Peninsula of Azerbaijan, and its major city, Baku. Other major ports include Astrakhan, Derbent, and the former Soviet naval station at Krasnovodsk, now in Turkmenistan. The most significant Iranian port on the Caspian Sea is the town of Bandar-e Anzali, the center of the Iranian caviar producing industry.

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## Catholic Church

SINCE THE BEGINNING OF Christianity, the extension and growth of the Catholic Church were a means to explore, map, and discover the world. Explorations were the first step in establishing missions in foreign lands, the cause of great travels around the globe. The Acts of the Apostles, and also ancient and medieval legends, tell about the missions of the apostles and first disciples in the ancient world (Paul in MALTA and Rome, Peter in Antioch and Rome, John at Patmos in the Greek islands, and the legendary presence of Thomas in INDIA, James the Elder in SPAIN, Joseph of Arimatea in England and Mary Magdalene in FRANCE, among others).

Southern Europe, part of Southwest Asia and North Africa were the first places where the new Christian religion propagated. The great moment of the Christian expansion was the Constantine Edict in 313. From then on, Christianity became the official religion of the Roman Empire. This was the start of an alliance between the church and political power that had a great impact on the diffusion of the Christian religion in the ancient world. Charlemagne gave to his Holy Roman Empire a religious mark and contributed to Christian social defense and expansion. The Byzantine Schism in 1054, separated from the Catholic Church the great part of the Christians of eastern Europe and Asia, from then on called Orthodox.

With the start of new religious orders in the 13th century (mainly Franciscans, Dominicans, Servants of Mary, Trinitarians, and Mercedarians) and with the organization in religious orders of groups of hermits (Augustinians and Carmelites), the missions had a great push. Thanks to the Franciscan John of Pian del Carpine and Odoricus of Pordenone, Christianity was preached for the first time in CHINA. The new religious orders were also leaders of the expansion of Christianity in America after the Christopher Columbus voyage. With the work of Dominican Bartolomé de Las Casas,

Native Americans were accepted as human beings and evangelized. After the separation of part of Christianity from the Catholic Church in the age of Reformation (16th century), Catholicism lost its influence in a great part of northern and central Europe, especially in GERMANY, England, SCOTLAND, a result of the principle "*Cuius regio, eius religio*" ("the religion of the prince has to be the religion of his people"). The church reacted to the reform of Martin Luther in France, John Calvin in Switzerland, and Henry VIII in England with the Council of Trent and founded new religious orders (Jesuits, Lazarists, etc.) nearer to the pope and less attached to monastic life. The rule of the missions of the Jesuits in India, JAPAN, South America, and CANADA has been very important since then.

In 1622, the Congregation of Propaganda Fide was created as the Roman department that had the direction of the Catholic missions. In the 19th century, a great role in the evangelization of America and Asia was played by Lazarists and Oblates of Immaculate Mary, a religious order founded by the bishop of Marseille, Eugenio de Mazenod. In this century, Oceania had its first catholic preacher in Peter Chanel, a French priest martyred in 1841 in Futuna, and Africa had great missionaries such as Daniel Comboni, founder of the Combonians Missionaries, and the Cardinal Lavignerie, founder of the order of the White Fathers.

With the leadership of Pope Pius XI, Catholic missions had a strong influence in the first half of the 20th century, and in the second half, mainly after the Vatican II Council (1962–65), the Catholic hierarchy was extended to a great part of the world.

### CATHOLIC CHURCH AND POLITICAL POWER

The Catholic Church had a very important role in the political history of the world. The Pontifical State, created in the first middle age (the first authentic document of pontifical sovereignty dates back to the 8th century), survived until 1870. The pope was the supreme authority of this state, which across the centuries had a different extension: For a long time, it ruled a large part of central ITALY, but since 1861 only the Lazio region has been under its rule. After the union of Italian kingdoms, the pope fought against the Italian government, and only in 1929 was there the Conciliation, a pacification act signed by the Italian premier at the time, Benito Mussolini, and the first minister of the Holy See, Cardinal Peter Gasparri (for Pope Pius XI). With this act, the new state of the VATICAN CITY was born, under the power of the pope, and at this time the Holy See recognized the Italian king-

dom. The Holy See has today separate diplomatic relations with the great part of the nations of the world.

The Pope is not the only Catholic bishop who had sovereignty. In the past, the bishop-prince of Trento, in northern Italy, was important, and the bishop of Urgel, in Spain, is also today one of the heads of state of ANDORRA. Also Catholic religious orders had sovereignty: Missions of Jesuits in Latin America, before their suppression, were a sort of independent republics. The Knights of Malta, a religious and military order, were sovereign in the islands of Rodi and Malta, and also today they have the sovereignty over the Knights of Malta palace and Church of St. Mary of the Priorate in Rome, and besides have embassies in a great number of nations in the world.

The Holy See prefers, in modern times, to have a regulation of relations with nations through special agreements called concordats. The first modern concordat was with Napoleon I in 1801, and today the Catholic Church has concordats with a majority of the nations in the world. In a lot of countries, there are modern political parties that declare their Catholic inspiration, but rarely does legislation adhere to the strictest tenets of the Catholic ethic, such as the prohibition of procured abortion, divorce, and artificial contraception.

### INFLUENCE OF CATHOLICISM ON GEOGRAPHY

Catholicism left a great imprint in the culture and way of life in many different parts of the world. Since the first times of Christianity, the enculturation of the new religion with the old culture was a prime effect. Greek and Roman culture, and culture of northern Europe, slowly integrated with Catholicism, with the substitution of the cult of the pagan gods with the cult of the saints. In time, almost everything in society had a special imprint by the religious Christian and Catholic culture.

One example is toponymy, the naming of places: In Europe and America, a great number of the names of places remember Catholic feasts, saints, and personages. CALIFORNIA in the United States remembers the work of Franciscan missionaries in cities such as San Francisco and LOS ANGELES (the latter named after Sancta Maria de los Angeles, the place near Assisi where Francis died in the 13th century), San Bernardino, San Diego (names of Franciscan saints). Corpus Christi, TEXAS, commemorates the Catholic dogma of transubstantiation, and the great number of places called St. Mary or Santa Maria are surely an ef-

fect of the Catholic devotion to the Virgin Mary. A great number of places have names of Catholic saints: Santa Catalina, St. Helen, Santa Anna, mainly in the places where Catholic missions had a important role in the exploration and foundation of new towns and villages. Another important effect is the diffusion of the names of Catholic saints among the newly converted people; this happened in the past and continues today.

Works of art, but also the life of the everyday, were inspired often by Catholicism: towns built around Catholic shrines (Loreto in Italy) or developed nearby (Lourdes in France, Fatima in PORTUGAL, Pompei and San Giovanni Rotondo in Italy). The great cathedrals built everywhere in Christendom were the centers of towns and communities. Religious orders, mainly Jesuits and Dominicans, that collaborated in the past to found very important cultural institutes, have today evolved into preeminent universities and colleges around the world. Other religious orders have hospitals, mainly in Africa and Asia. All this is not to mention the Catholic calendar feasts that have become common holidays (holy days) in many nations around the world.

### CATHOLIC CHURCH IN THE WORLD TODAY

The Catholic Church today is present everywhere in the world, with 1.1 billion baptized Catholics, comprising 17.3 percent of the entire world population (16.77 percent of that population in Africa; 62.71 percent in the Americas; 2.89 percent in Asia; 39.96 percent in Europe; and 26.77 percent in Oceania). It is locally structured in 7,726 dioceses.

In Europe, the Catholic presence is very strong, mainly in Italy (227 dioceses), IRELAND (26 dioceses), Spain (71 dioceses), PORTUGAL (21 dioceses), POLAND (45 dioceses), BELGIUM (9 dioceses), Malta (2 dioceses), and France (98 dioceses). In the Irish Republic as in Italy, the feeling of being part of Catholicism is one with national patriotism. In Ireland, the long dominance of the British government and the imposition of Anglicanism as a national religion led Catholicism to be identified in Irish minds as a national resource. In Italy, the presence of the pope and the difference of culture and way of life between the north and south turned Catholicism into a traditional, common cultural heritage for the Italian people.

France has a great religious tradition, evident today in the popular shrines as Lourdes, St. Therese of Lisieux, St. John Vianney of Ars, but this tradition has to live together with a strong state laeity, coming from the liberal ideas of the French Revolution and Enlight-

enment. State and church are completely separated today in France, and this has also some consequence on education, with laws that forbid any symbols of religion (whether Catholic or Islam) in state schools. The Catholic Church in Belgium has to fight the secularization of culture, but it also has important centers of Catholic culture, such as Lovanio Catholic University and the ancient Society of Bollandistes in Brussels, the most important institution to study hagiography.

Spain has an ancient and strong religious tradition, as the Holy Week religious manifestations, mainly in Seville, and the famous shrine as Santiago de Compostela testify, but today some scholars point to a decadence in religious practice. Portugal has its religious center in the shrine of Our Lady of Fatima, one of the most visited in the world, and also has a great popular Catholic devotion. In the other nations of northern Europe, except Northern Ireland, where political problems involve too much religion, the ecumenical movement is very developed, and Catholics are in good stead with the other separated Christian churches (various Protestant denominations).

In the nations of eastern Europe, the Catholic rapport with the Orthodox Churches is good; only in RUSSIA are there problems with the Orthodox hierarchy, but the situation is getting better. In 2004, the restitution of the icon of Our Lady of Kazan by Pope John Paul II to the Russian Patriarchate of Moscow helped this pacification process. The same pope, John Paul II, was one of the protagonists of the new Poland, after the fall of communism, and Poland today is still a nation with strong Catholic traditions, as evidenced in the popularity of the national shrine of Our Lady of Czestochowa. In AUSTRIA (12 dioceses), there is a demand for a renewal of Catholicism, opposed by the hierarchy. SWITZERLAND (8 dioceses) is only partly Catholic, but it gives to the Holy See the soldiers for the small army of the pope, the Swiss Guard. Also relevant are the Catholic communities in Great Britain (32 dioceses), Germany (29 dioceses), NETHERLANDS (8 dioceses), LITHUANIA (8 dioceses), LATVIA (4 dioceses), ESTONIA (4 dioceses), UKRAINE (20 dioceses), CROATIA (16 dioceses), ROMANIA (12 dioceses), and HUNGARY (16 dioceses).

The presence of Catholics in Asia is mainly in the PHILIPPINES (86 dioceses), where the majority of the population are members of the Catholic Church. There are Catholic schools and universities, and Catholicism plays an important part in daily life.

In JAPAN (16 dioceses), the presence of Catholics is important, but it is a minority. There are Catholic

schools, and Catholic education is appreciated. Catholics of Japan have their own national shrine to celebrate St. Paul Miki and the others Japanese martyrs, patron saints of Japan.

In India (149 dioceses), the Catholic presence is small compared with the great number of inhabitants, but nevertheless important. The Malabaric Church dates back to apostolic times, and charismatic personalities, such as St. Francis Xavier and Mother Theresa of Calcutta, promoted Catholicism. SRI LANKA, thanks mainly to the missionary work of Joseph Vaz and Bishop Horace Bettacchini, has several catholic communities, with 11 dioceses.

In ISRAEL (2 dioceses) and PALESTINE (2 dioceses), Catholics live in small communities of Arab Christians, and are mostly related to the Franciscans Friars of Holy Land Custody, and other religious communities holding custody of the shrines of the Holy Land.

In SAUDI ARABIA and other nations where Islam is the official religion of the state, the presence of Catholics is restricted mainly to the chapels of foreign consulates. In some Islamic countries, there are ancient Catholic communities, such as the Chaldean Church in IRAQ (15 dioceses), or even new communities, such as the Church of Pakistan (7 dioceses). These parishes survive with great difficulties, often discriminated against by the majority.

In China, the Catholic Church had a very important presence (145 dioceses) before the Cultural Revolution in the 1970s. Today, Catholicism is restricted, except in HONG KONG. The government of China created a "Patriotic Church," a sort of Catholic Church separated from Rome, with the aim to bring Roman Catholics into the government-run version. In TAIWAN (13 dioceses), Catholicism is thriving, while in MONGOLIA, a small Catholic community is developing (1 diocese). VIETNAM (25 dioceses), South KOREA (18 dioceses), INDONESIA (37 dioceses), MALAYSIA (8 dioceses), LEBANON (24 dioceses), and SYRIA (17 dioceses) have a good number of Catholics as well, all within countries with majorities from other religions.

In Africa, Catholicism is growing, mainly in the center and in the south. The greatest problem of enculturation of Catholicism is still to be solved. For example, the Catholic people of RWANDA (9 dioceses) and BURUNDI (7 dioceses) cannot find a real peace after terrible tribal wars. The greatest Catholic shrines in Africa are the Church of Our Lady of the Peace of Yamossoucro in CÔTE D'IVOIRE (14 dioceses), the cathedral "Regina Mundi" of Port Said, in EGYPT (21 dioceses), the cathedral of Our Lady of the Help of Wau in

SUDAN (9 dioceses), the church of Our Lady of Africa of Algeri in ALGERIA (4 dioceses), and the Church of Our Lady of Maromby, in MADAGASCAR (20 dioceses).

Religious orders, such as Capuchins, Trappists, Combonians, Scalabrinians, and others have a large number of schools, universities, and hospitals in Africa. In KENYA (26 dioceses), the Catholic University of Western Africa is developing. Cults of local saints are encouraged by the Holy See with beatifications and canonizations, such as St. Charles Lwanga in UGANDA (20 dioceses), blessed Isidoro Bakanja and blessed Clementine Anuarite Nengapeta in CONGO (54 dioceses), and Iwene Michael Tansi in NIGERIA (49 dioceses). Other important Catholic communities are in ZAMBIA (10 dioceses), SOUTH AFRICA (27 dioceses), SENEGAL (7 dioceses), TANZANIA (30 dioceses), LESOTHO (4 dioceses), MOZAMBIQUE (12 dioceses), ANGOLA (16 dioceses), BENIN (10 dioceses), BURKINA FASO (12 dioceses), CENTRAL AFRICAN REPUBLIC (8 dioceses), CHAD (8 dioceses), and MALAWI (7 dioceses).

In North America, the Catholic presence is very active. In a place where most of the population comes from European origins, people have preserved their religions from their nations of origin. In CANADA (72 dioceses), most of French-speaking residents are Catholic. Echoing their counterparts in France and northern Europe, there is widespread devotion to St. Anne, who with St. Joseph dedicated the most important Catholic shrines of Canada, including the church of Notre Dame du Cap in Quebec.

## U.S. CATHOLICISM

In the UNITED STATES, Catholicism struggles to maintain its hold in light of the widespread scandal of priests accused of pedophilia. Many U.S. Catholics oppose the dictums and prestige of the Roman church hierarchy. Jesuits are devoted to schools and education. The national shrine for Catholics is the Church of Mary Immaculate of Washington. The United States has diplomatic relations with the Vatican, but not a concordat.

In the United States, there are some 18,400 members of religious orders (friars and nuns); Benedictine nuns number about 7,000. This great number of religious people, and the existence of local religious orders, such as the Sisters of the Blessed Sacrament for Indians and Coloured People, founded by St. Katharine Drexel in 1891, seem to portend a positive Catholic force in the United States.

Yet, despite these numbers, the number of Catholics in the United States has declined steadily since



1980. And there is a crisis of vocation, mainly in female institutions: American women do not like the secondary role that the Catholic Church reserves for women.

Catholic presence in Central and South America is very strong, a result of the heritage of Spanish and Portuguese colonization. Catholics have a good number of universities and schools, even if some nations have a laic state tradition. BRAZIL today has the greatest number of Catholic bishops and dioceses (266) in the world. Catholicism is sometimes mixed with ancient pagan cults, forming a very special way to practice the religion.

Great monuments testify to the Catholic faith of Latin Americans: The great statue of Christ on Corcovado (Rio de Janeiro in Brazil) is one of the more famous religious monuments in the world. The shrines of Our Lady of Guadalupe in MEXICO (125 dioceses), Our Lady Aparecida in Brazil, Our Lady of Lujan in ARGENTINA (70 dioceses), and Our Lady of Altagracia in the DOMINICAN REPUBLIC (12 dioceses) are very famous.

Also in the other nations of Latin America there are vibrant Catholic communities with their own traditions and devotions, such as St. Rose of Lima and St. Turibio of Mogrovejo in PERU (45 dioceses); Our Lady of Carmel in CHILE (27 dioceses), and others in BOLIVIA (18 dioceses), ECUADOR (24 dioceses), VENEZUELA (39 dioceses), COLOMBIA (75 dioceses), URUGUAY (10 dioceses), PARAGUAY (15 dioceses), GUATEMALA (14 dioceses), PANAMA (8 dioceses), HAITI (9 dioceses), COSTA RICA (7 dioceses), HONDURAS (7 dioceses), EL SALVADOR (9 dioceses), CUBA (11 dioceses), and NICARAGUA (8 dioceses).

A theological movement, called Theology of Liberation, has developed in the second half of the 20th century to address pervasive social problems of Latin America. The Vatican opposed the movement's political aims, particularly using violence to fight for the social needs of the poor, and its adherence to Marxist ideology.

Because there is a low number of priests in Brazil, a new catholic society called "Comunità di Base" has been created. In this society, a democratically elected lay person is the head of the religious community, hence allowing for the development of the Theology of Liberation. Sometimes, these poor communities are abandoned by the official Catholic hierarchy.

AUSTRALIA (32 dioceses) has a good number of Catholics, the great part descendants of emigrants from Italy and other nations with a Catholic majority. A very important religious and cultural center is the Benedictine Abbey and the town of New Norcia,

founded by Benedictine monks in the 19th century. A relevant Catholic presence is also found in NEW ZEALAND (7 dioceses) and in PAPUA NEW GUINEA (19 dioceses), where there is a great veneration for blessed Peter To-Rot, the first local resident to be beatified. The SOLOMON ISLANDS (3 dioceses) and the other islands of the Pacific (17 dioceses) have Catholic communities, too.

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## Caucasus Mountains

THE CAUCASUS MOUNTAINS are the highest mountain range in Europe, but lie at the very eastern extremity of what geographers consider to be Europe. In fact, the dividing line traditionally used to divide Europe from Asia runs directly through the center of the range.

Forming both a barrier and a connector for civilizations between the BLACK and CASPIAN seas, and between the MIDDLE EAST and the STEPPES to the north, the cultures of the Caucasus region have occupied a central place for trade and cultural exchange for over 2,000 years. The range's isolated valleys have served as a haven for refugees and immigrants from many areas, resulting today in one of the most ethnically and linguistically diverse regions on Earth.

The two major ranges of the Caucasus, the Great Caucasus and the Lesser Caucasus, stretch east to west for nearly 550 mi (900 km) from the eastern shore of the Black Sea to Baku on the Caspian. Elevations generally rise from both ends towards the central range, in which the highest peaks are located, including Mount ELBRUS, the highest peak (18,506 ft or 5,642 m). The various ranges and subranges are similar in their mountain characteristics: jagged and generally impass-

able. Climatically, however, west and east differ dramatically, due to the effects of moisture off the Black Sea and the contrasting dryness of the Caspian. As a result, the western ranges tend to have a subtropical climate, with heavy vegetation, while the eastern part of the range is semidesert and barren. The Caucasus Mountains share many characteristics with the ALPS, but their peaks are generally much taller, averaging 6,000 to 9,000 ft (2,000 to 3,000 m)—over 20 summits are higher than Mont Blanc. Its ridges are mostly parallel, running from west-northwest to east-southeast, but are broken up by horseshoe-shaped ridges with glacier-filled basins. Many of these are unstable, subject to frequent landslides and avalanches. Most of the ridges are more continuous than those of the Alps, resulting in a greater barrier, with only one major pass—through the dramatic Daryal gorge—and several smaller ones that are usually obstructed by snow. As a result of several of these features, the Caucasus Mountains are generally more inhospitable than the Alps and have a more wild and austere quality.

The Caucasus ranges were formed in the same manner (and at roughly the same time) as the Alps, through tectonic plate collision between the Arabian Plate and the Eurasian Plate. This movement continues today, manifesting itself through regular earthquakes. Many years ago there was volcanic activity in the region, creating some of the tallest cones (like Elbrus), but these volcanoes are currently extinct, with the exception of the active mud volcanoes of the Apsheron Peninsula, which juts 53 mi (85 km) into the Caspian Sea. It is here where the most important of the region's natural resources are located—the offshore oilfields of AZERBAIJAN. Other oil resources are found on the northern slopes, near the cities of Grozny and Krasnodar. At the western extremity of the range, the Caucasus also extend a bit further than the land they occupies, forming the low mountains of the Taman Peninsula, which nearly joins with the Kerch Peninsula of the Crimea, across the mouth of the Sea of Azov.

The Great Caucasus range is divided from the Lesser Caucasus by a parallel valley, the Transcaucasian depression, averaging 60 mi (100 km) in width. This depression connects the Black Sea coast with the Caspian Sea, where elevations dip below sea level. The depression is divided in two by a low range perpendicular to the main ranges, the Surami, which forms the climatic barrier between the moist west and the dry east. To the west of this range lies the Colchis Lowlands, the “Riviera of the Caucasus,” with grapes and olives and holiday resorts. To the east lies the Kura

Lowland, dominated by the Kura River, the longest river in the Caucasus, which flows out of the Armenian Highlands, past the industrial city of Tbilisi to the Caspian Sea near Baku. Near its mouth, the Kura is joined by the Araks River, which starts in eastern TURKEY and forms the border of ARMENIA and Azerbaijan with Turkey and IRAN to the south. This basin was actually part of the Caspian Sea in times of higher water levels. Other major rivers of the Caucasus region flow north, cutting gorges through the Great Caucasus: the Kuban, which flows into the Black Sea, and the Terek and Sulak, which flow across Dagestan into the Caspian.

The Great Caucasus is itself divided into several ranges, the most important being the Main Range and the Front Range. The Main Range forms the drainage divide between north and south. A few kilometers to the north, the Front Range is less continuous, but has the highest peaks in the entire system (the extinct volcanic cones like Elbrus). To the north lies the Stavropol Plateau, which gradually slopes to the steppes of southern RUSSIA. Other prominent peaks besides Elbrus in the central section of the Great Caucasus include Dykh-Tau and Shkara, both just over 16,500 ft (5,000 m), and the slightly lower Koshtan and Kazbek. Mount Kazbek (also called Mkinvari) marks the easternmost part of the central range and is the second-most popular peak for mountaineers, after Elbrus. The eastern end of the range descends gradually toward the Caspian Sea, breaking up into isolated massifs rather than continuous chains. This region of low dry hills resembles the badlands of SOUTH DAKOTA. The Lesser Caucasus are less defined as parallel west-to-east ranges; instead they generally merge into the Armenian Highlands, and the Anatolian and Iranian plateaux to the south. Here the peaks are generally lower, 3,000 to 7,000 ft (1,000 to 2,000 m), and several of the elevated valleys have been filled in by volcanic material forming an elevated surface.

Three nations with completely different ethnic and linguistic roots dominate the southern slopes of the Caucasus (called Transcaucasia by Russocentrics, but more acceptably, the South Caucasus): GEORGIA, Armenia and Azerbaijan. Each of these has numerous ethnic minorities within its borders, many of which are currently embroiled in struggle for autonomy or outright independence, for example, Ajaris, Ossetians, and Abkhazians. North of the main range, Russians form the majority of the population (having settled there during the reign of Catherine the Great in the late 18th century) but also contend with separatist movements

of Caucasian peoples, notably the Chechens, Kabardians, and the many tribes of Dagestan. The crest of the Great Caucasus generally forms the border between Russia and the South Caucasian states, but their other borders are not as easily defined by the confusing knot of the Lesser Caucasus, resulting in several contemporary border conflicts, notably Nagorno-Karabagh, claimed by Azerbaijan and occupied by Armenia. Among the resources quarreled over are oil, which CHECHNYA has and Russia wants, and water, which Armenia has and Azerbaijan wants. Azerbaijan has access to the vast offshore reserves of Caspian Sea oil but needs the cooperation of Georgia to deliver its product to the West via pipelines to the Black Sea. Having achieved independence at the dissolution of the Soviet Union in 1991, much of the region still depends on Russia for electricity and other basic needs, despite its desire to reconnect ties both towards western Europe and the Middle East.

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## Cayman Islands

THE CAYMAN Islands are one of the UNITED KINGDOM few remaining colonies in the CARIBBEAN SEA. The group, lying roughly 150 mi (250 km) northwest of JAMAICA, consists of three main islands, Grand Cayman, Little Cayman, and Cayman Brac. They were first named Las Tortugas by Christopher Columbus in 1503 because of the abundance of turtles, and turtles remain one of the chief natural features of the islands. Later, the islands were named for their other large reptile residents, *lagartos* (alligators), then *caymanas*, the Carib word for "crocodile."

The islands are low-lying limestone formations, surrounded by coral reefs, providing habitat for abundant marine life. Because the soil is so dry and thin, the islands have never been able to grow much agriculturally, and there are no rivers or streams. The islands are the tops of a submarine mountain ridge that extends

from BELIZE to CUBA. Parallel to the Cayman Ridge is the Cayman Trench, the deepest part of the Caribbean Sea—Bartlett Deep plunges over 18,000 ft (5,455 m). An abundance of healthy coral reefs draw numerous divers each year, particularly to the Bloody Bay Marine Park off of Little Cayman, one of the most diverse coral walls in the area. Cayman Brac and Little Cayman lie about 89 mi (144 km) northeast of Grand Cayman, and have a more varied topography, especially on Cayman Brac, with its high bluff, sheer cliffs, and caves. Grand Cayman is flatter and has a large, shallow reef-protected lagoon, the largest area of inland mangrove in the Caribbean. Almost all of the population lives on Grand Cayman. Little Cayman has almost no population but is home instead to nesting birds.

The Caymans formed part of the Spanish colony of Jamaica from the 16th century but were never settled and passed with Jamaica to the British crown in 1670. British presence was established mostly as a refueling station (for food and water provisioning), and the islands were administered as an appendage of Jamaica until that island's independence in 1962. Shark and turtle farming was the only economic activity until the development of tourism and finance in the later 20th century.

Today, the Cayman Islands are the fifth-largest offshore financial center in the world, employing most of its labor force and providing its residents with one of the highest standards of living and no direct taxation. In 1998 there were more than 40,000 companies registered in the Cayman Islands, including nearly 600 banks. Registration of ships and corporation brings in a large amount of government revenue. About 70 percent of the gross domestic product comes from tourism: More than 1.2 million visited in 1997, mostly from North America. A constant danger, however, lurks in the many Caribbean storms and hurricanes (cyclones)—Hurricane Gilbert, the most powerful storm recorded in the Western Hemisphere, hit the Caymans in 1988. A Category 5 storm, Gilbert's sustained winds of over 155 mi (249 km) an hour leveled nearly every structure on the islands.

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## Central African Republic

**Map Page** 1115 **Area** 240,535 square mi (622,984 square km) **Population** 3,683,538 **Capital** Bangui **Highest Point** 4,658 ft (1,420 m) **Lowest Point** 1,099 ft (335 m) **GDP per capita** \$1,200 **Primary Natural Resources** diamonds, uranium, gold.



DEEP IN THE HEART of the African continent, the LANDLOCKED Central African Republic is on a heavily forested plateau about the size of TEXAS between the Chad and CONGO RIVER basins. It is bounded on the north by CHAD, SUDAN to the northeast, the Democratic Republic of the CONGO (formerly Zaire), CONGO to the south, and CAMEROON to the west. The area has a tropical climate with two annual wet seasons, May-June and October-November. However, in the very dry summer, the Harmattan, a hot, dust-laden wind blows in from the SAHARA DESERT with a saunalike effect in the cities.

From the 1500s until the 1800s, the area was ravaged by the slave trade. In 1894, the French occupied the region, then called Oubangui-Chari, and combined it administratively with Chad, GABON, and the Middle Congo to become French Equatorial Africa. In 1946, the French granted internal self-government. On August 13, 1960, President David Dacko proclaimed complete independence but alarmed the Western powers when he aligned with communist CHINA. He was overthrown in a coup on December 31, 1965, by Jean-Bédél Bokassa, his cousin and army chief of staff, who then declared himself Emperor Bokassa I.

Allegations of brutality and excess characterized his regime, with Amnesty International charging he participated in the massacre of 80 schoolchildren. In 1979, he was ousted by a coup supported by French paratroopers. Dacko returned to power, but an army coup deposed him again. From 1996 to 1998, violence between the government and rebel groups prompted the United Nations to send in an all-African peacekeeping force. Although elections were held in September 1999, repeated coups have followed.

Although the nation is rich in natural resources, including diamonds, gold, and oil, more than 70 percent of its citizens are subsistence farmers working only 3 percent of the land. Large stands of timber cover 75 percent of the country and surveys suggest extensive

additional mineral wealth. Poaching has diminished the republic's reputation as one of the last great wildlife refuges and the populace suffers from a high mortality from AIDS, with 13 percent of the population HIV positive. Life expectancy is 41.71 years.

The official language is French, but Sangho is used for commerce and intertribal communication between 80 ethnic groups, of which the largest are Baya (34 percent), Banda (25 percent), Nabandi (11 percent), Azande (10 percent), and Mbaka (5 percent). In July 1990, a decree gave the nation's 10,000 pygmies full citizenship. A small European community remains, the majority of which are French or Portuguese descendants. Christians account for 83 percent of the population, of which 33 percent are Roman Catholic and 50 percent are Protestant. An estimated 12 percent of the population follows animist traditions and 3 percent are Islamic.

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## Central America Free Trade Agreement

THE CENTRAL America Free Trade Agreement (CAFTA) is a treaty between the UNITED STATES and the countries of Central America (HONDURAS, GUATEMALA, EL SALVADOR, NICARAGUA and COSTA RICA)—what the Russians refer to as the "near abroad." This is a parallel to the earlier NAFTA (North American Free Trade Agreement). The objective is a free-trade association between the countries of Central America and the United States. It is to replace the Caribbean Basin Initiative (CBI), a unilateral agreement by the United States allowing 80 percent of Central American products to enter the United States with minimal or no duty. The CBI was designed to expire in 2007. This new agreement will focus on the land-based countries and not the islands.

As with NAFTA, the objective of the agreement is to create a common set of rules and standards to regulate commercial trade in both goods and services. It



also has the objective of creating an economic environment that will benefit local people and thus create more stable governments. To this end, governments must privatize current government monopolies. Government-owned telecommunications were a major sticking point for Costa Rica, which at the end of 2003 asked for more time to negotiate and adjust. As of October 2003 all countries, except Costa Rica, had reached agreement. Costa Rica sought and was given an extended period for final negotiations.

The United States is the main customer of Central America (\$11 billion in 2002—over 43 percent of total exports from Central America). Conversely, the U.S. trade with Central America is more than its trade with INDIA and RUSSIA combined. With the implementation of CAFTA (with or without Costa Rica) this trade is likely to increase rapidly. In addition, there will be many more American companies willing to open new businesses in Central America.

A hidden wild card in all this is the future status of CUBA. It is widely agreed that once the U.S. embargo on Cuba ends, Cuba will become the dominant economic power in the Caribbean Basin. NAFTA and CAFTA may provide sufficient regional cooperation to also provide competitive strength when this happens. It seems that the strategy of CAFTA is to provide a treaty distinct from anything that may occur in the islands.

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## central business district

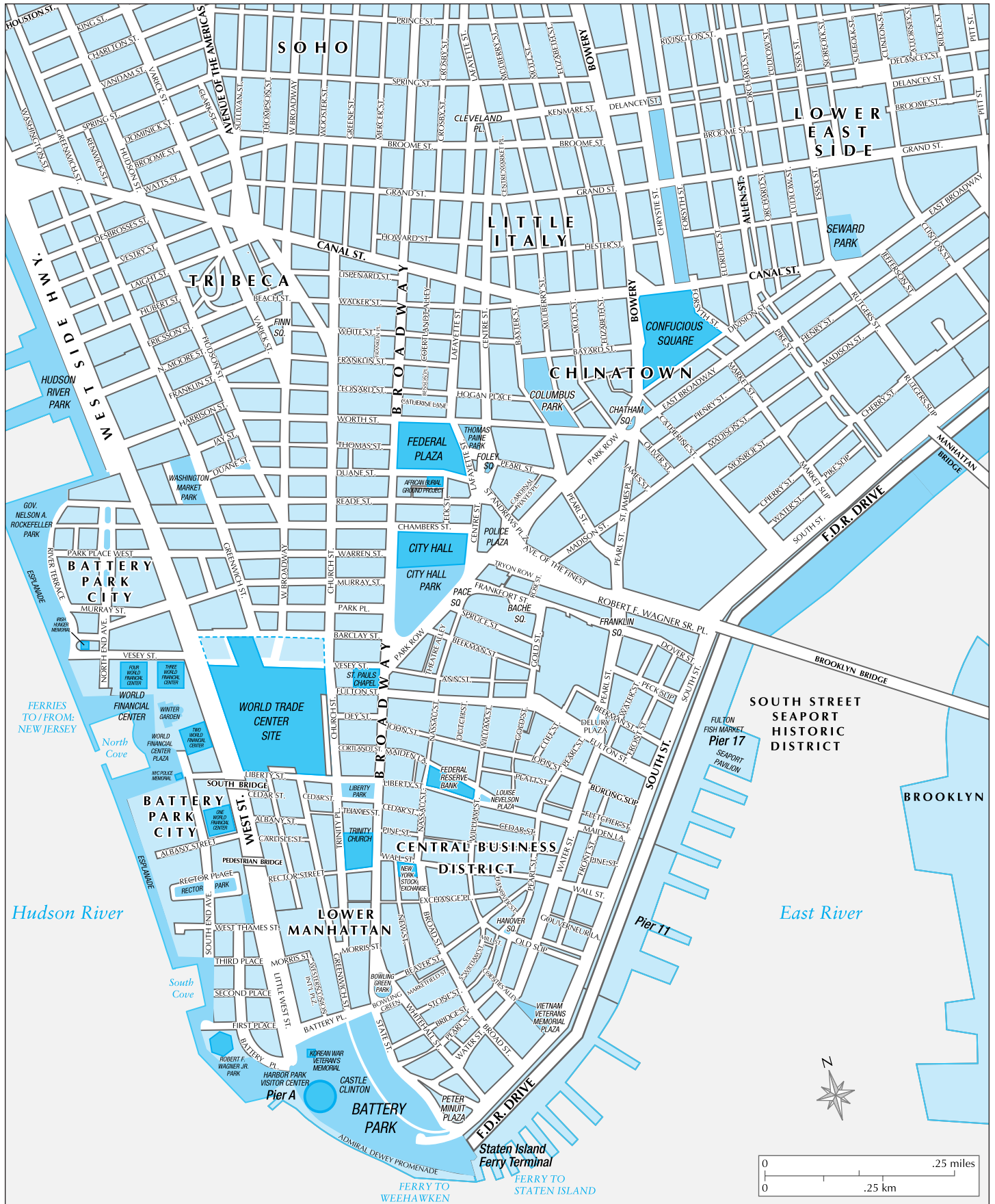
A CENTRAL BUSINESS District (CBD) is the nucleus or downtown of an urban area that contains the main concentration of commercial land use, with the highest percentage of retail shops, offices, and services such as banking and finance. Large cities are characterized by distinct retail sub-areas that have their own “walking district.” Some specialized clusters of nonretail activities can be found, such as law offices, medical facilities, and offices services. Applicable to any city, the CBD is

found in global cities with international and financial business centers such as NEW YORK, LONDON, TOKYO, PARIS, Frankfurt, Zurich, Amsterdam, LOS ANGELES, HONG KONG, and SINGAPORE. In global cities where the CBD is strong, advantages include local expertise, world-class technology, specialized knowledge, and networking capabilities. There are slight differences in the patterns of CBDs around the world.

The concentration within a CBD is associated with high land values because of high accessibility. These characteristics of urban location are similar to the William Alonso model. The CBD has been identified as a district area after the general theories of city structure in the 20th century. There has been no specific defined geographic area for a downtown, unlike the boundaries of a city for example. In their pioneer work, the urban geographers, Raymond Murphy and James Vance (1954), found a number of indices by which the CBD could be physically delimited. However, their method required a large amount of land use and building use data, and thus it was rarely used. The CBD has the highest concentration of land uses and in general the tallest nonresidential buildings. It is spatially structured internally, with different specialist areas to benefit from the external economies associated with agglomeration. Vertical segregation exists also with uses that can afford the highest rent on the ground floors of high-rise buildings.

Methods for the delimitation of the CBD include mapping land use intensities referring to the central business height index, recording the percentage of the land uses of each floor of each building within the CBD, and calculation of high-level pedestrian flows. The Manhattan CBD is, for example, characterized by very high offices blocks and a lack of residential buildings, which has the result making the area deserted after offices hours. In the 1970s, planners introduced the development of a resident-friendly concept, such as gentrification, to bring night life back to the downtown area. The Marunouchi District, the heart of Tokyo's CBD located near the Tokyo Station (through which more than 700,000 passengers each day commute), is characterized by the new massive Marunouchi building complex. It attracted more than 13 million visitors during its first six months.

However, characteristic of many CBDs, the three Tokyo core wards of Chiyoda, Chuo, and Minato have a nighttime population of 268,000 persons but a daytime population is 2.341 million persons. Some large cities as London and Tokyo have several CBDs. Moreover, if the CBD remains a strategic area for leading



industries, it is reconfigured by technological and economic change. Many CBDs are facing several problems, such as congestion that has led to parking restrictions, and decline not only with the increasing growth of out-of-town developments with shopping centers and office parks very close to major highway intersections, but also with the cyclical decrease of business activity.

In New Orleans, LOUISIANA, after the oil industry collapse in the 1980s, almost all office inventory was abandoned as companies went out of business; and the occupancy of the CBD only ever achieved 90 percent of the capacity. After the technology bubble burst in San Francisco, CALIFORNIA, office space rates fell as much by half.

### NEW BEIJING CBD

In booming economies such as in CHINA, infrastructures in new CBDs are being built. In BEIJING, workers are clearing the CBD of its aging textile factories and railroad workshops for a \$20 billion complex. This new CBD is a way for China to create an image of a modern capital in line with London, Paris, and New York. The conventional CBD, as a highly concentrated core with international business, has been questioned in light of the information technology age. If centrality was synonymous with the CBD, today the new technologies and the organizational forms have changed the spatial correlates of centrality. Some questions on the future of financial districts have been raised, particularly when looking at the virtual configuration of the electronic system.

The informational economy tends to be concentrated in global cities, creating a new international division of labor. Global cities come at the top of the information hierarchy and are characterized by a high concentration of information flow and processing. The accessibility and centrality for a CBD is no longer justified, as was the case when face-to-face contacts were a necessity in business. However, clustering of services and proximity do produce agglomeration economies, and in a CBD, the services and marketing relations can, for example, enhance the quality of the services.

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## Chad

**Map Page** 1115 **Area** 495,752 square mi (1,284,000 square km) **Population** 9,253,493 (2003) **Capital** N'Djamena **Highest Point** 11,204 ft (3,415 m) **Lowest Point** 525 ft (160 m) **GDP per capita** \$1,000 **Primary Natural Resources** petroleum, uranium, fish.



THE REPUBLIC OF CHAD is a LANDLOCKED country located in north-central Africa. It is bounded by LIBYA, NIGER, NIGERIA, CAMEROON, the CENTRAL AFRICAN REPUBLIC, and SUDAN. The country is about 85 percent of the size of ALASKA. Chad got its name from Lake CHAD, which lies on the western border with Niger and Nigeria. The lake decreases in size during the dry season. The south is mostly wooded terrain, which becomes brushy as you near Lake Chad. From the lake, the land rises gradually to the Ennedi Plateau and the Tibesti Ranges, formed from volcanoes. Some of the mountains reach a height of 11,000 ft (3,353 m). The SAHARA DESERT covers part of the northern half of the country. The two important rivers in Chad, the Chari and the Logone, both flow into Lake Chad. They are used for crop IRRIGATION and during some seasons are navigable.

There are three climatic regions in Chad. The south has a more tropical climate, with wet and dry seasons. The central zone is covered by sand and has light rain. The northern area has a true desert climate, with hot, arid conditions and almost no rain. Chad's population is made up of many different ethnic groups. Most of the population is concentrated in the south, and the people there live sedentary lives, pursuing agriculture. The people include the Sara, Massa, Ngambaye, and Moundang. Most of them are Christians, but a few still follow traditional religions.

The people of the north are nomadic or seminomadic and are Muslims. They include Arabs, Tuareg, Hadjerai, Fulbe, and Toubou. There are two official



languages in Chad—Arabic and French. Many of the people speak tribal languages and dialects, too.

N'Djamena, the capital and largest city, has about 530,000 people. Other cities include Moundou, Sarh, and Abeche.

The southern area, around Lake Chad and the two rivers, is the most fertile area of Chad, and most of the food for the country is grown there. It is also the only area with much animal life, which consists mainly of birds and antelope. Economic development in Chad has been severely hampered by its landlocked position, poor transportation, political turmoil, and lack of natural resources. Some textiles are produced in Chad, and there are food-processing operations as well. Their imports of machinery, transportation equipment, food, petroleum products and industrial goods outweigh their exports of cotton, cattle, textiles, and fish. Their chief trading partners are SOUTH AFRICA, Cameroon, and FRANCE. Chad has one of the lowest per capita incomes in the world.

Chad's position near Lake Chad has always made it a focal point of Saharan trade routes. This has caused dissension and turmoil through the years, as different groups wanted to control the routes. Finally, a democracy was established in 1996 and multiparty presidential elections were held. But since that time, there have been disputes and fighting within the country.

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## Chad, Lake

**LAKE CHAD** IS A shallow freshwater lake located in west-central Africa. Only 23 ft (7 m) at its deepest, it is 820 ft (250 m) above sea level, and was once larger than the state of VERMONT. In the 1960s, Lake Chad was approximately the size of lake ERIE, one of the Great Lakes located in the Midwest region of the UNITED STATES. In the past 40 years, however, Lake Chad has shrunk to less than the size of RHODE ISLAND. Reasons are twofold: a drier climate, with less water replenishment by monsoons; and water siphoned off for agricultural irrigation purposes has quadrupled to provide for the 20 million people living in the four

countries (Chad primarily, but also CAMEROON, NIGER, and NIGERIA) that include Lake Chad in their borders.

To illustrate the lake's reduction: Its surface area measured 10,000 square mi (25,000 square km) in 1963 but had shrunk to 839 square mi (1,350 square km) by 2001, causing the lake to become one-twentieth of its original size. The most significant decrease occurred between 1973 and 1987. Still, Lake Chad is the fourth-largest lake in Africa, with only Lakes VICTORIA, TANGANIKA, and MALAWI superior in size. It is a central point of the region for many reasons, including the important archaeological discoveries found nearby. This region contains some of the earliest evidence of hominids; the area has been occupied, nonstop, since perhaps 500 B.C.E.

Other pivotal roles of the lake and its perimeter include the area's prominence in the region's trade, the massive irrigation projects that rely upon its waters, and the flora and fauna that grow—and the wildlife that live—nearby. Fish quantities, however, are significantly decreasing, a concern since fish provide a source of protein for the population.

Because of the decrease in fish, along with other signals of environmental distress, the lake and surrounding basins have been declared a "disaster zone." A research paper exploring the devastation, "Human and Natural Impacts on the Water Resources of the Lake Chad Basin," appeared in the American Geophysical Union's *Journal of Geophysical Research* in 2001. Britain's Department for International Development in Nigeria, however, offers a more optimistic outlook. According to their experts, the shrinkage of Lake Chad has created more farmland, land that is fed by the lake when its boundaries expand during rainy weather. Leftover fish manure fertilizes this farmland, adding to fertility, and this combination allows farmers to survive three-month drier periods. Significant famines have not occurred in this region, and people living by the lake are effectively fed by agriculture.

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## Changjiang (Yangzi River)

THE CHANGJIANG cuts through the heart of CHINA and is regarded by the Chinese as the geographical marker dividing the country into north and south. It winds its way through the 10 provinces of Qinghai, Tibet, Yunnan, Sichuan, Hubei, Hunan, Jiangxi, Anhui, Jiangsu and Shanghai before reaching the East China Sea. Its fertile ALLUVIAL PLAINS produce great amounts of wheat, cotton, tobacco and silk. The Changjiang or Yangzi River dominates the center of China both north-south and east-west. It is thus one of the major factors affecting China's future industrialization and food production.

Changjiang means "long river" and that it is. China's Changjiang is the third-longest river in the world (after the AMAZON and NILE). It is over 3,960 mi (6,300 km) long and comparable in economic importance to the MISSISSIPPI in the UNITED STATES. Originating in the Tanggula Shan of eastern Tibet, the Changjiang passes through and links the fertile Red Basin of Sichuan province with the THREE GORGES and their new and massive hydroelectric project as well as the central food basket provinces of Hunan-Hubei. It finally exits to the sea at Shanghai. Altogether it links eight provinces, several major urban and industrial cities and innumerable ecological regions.

The Changjiang is China's longest navigable river; ocean-going ships are still able to pass as far inland as the Municipality (an autonomous city) of Chongqing. It also is China's major hydroelectric focus. The Three Gorges Project is designed to provide clean electric power to all of Sichuan and as far eastward as the Shanghai economic cluster. Just from Sichuan to Shanghai, the Changjiang corridor produces 40 percent of the nation's grain, including 70 percent of the rice, 33 percent of the cotton, 48 percent of the freshwater fish, and over 40 percent of the total industrial output, which is likely to increase significantly with completion of the Three Gorges project. And with an abundance of fresh water, there are plans to divert some to water-deficit areas in North China.

The key to understanding the geography, and thus the human significance, of the Changjiang is to realize that it is one river that links six distinct geographic environments and cultures. (Think of these as like a series of distinct boxcars along a rail line with the river being the connector or "line." Each "car" contains distinct cities, climates, and economics.)

*Chamdo-Tibet:* This beginning of the Changjiang is an area of steep valleys, heavy snowfall, and strong

springtime floods. None of the river is navigable, soils are rocky and slopes steep, thus preventing any large-scale settlement by farmers. Most people are Tibetan or tribal and not of the dominant Han Chinese.

*Sichuan:* Leaving the TIBETAN PLATEAU the river's tributaries add water to form that portion in the Red Basin which was the site of the ancient Shu culture. Once a large lake, and with a mild climate, the Sichuan or Red Basin has very fertile soils. This has meant a surplus of food and a very large agrarian population. Until it reaches the area near modern Chongqing, it is navigable to only moderate-sized boats still capable of carrying significant cargoes.

*Three Gorges:* The site of the ancient Ba culture, the mountains that separate the Red Basin from the Central Plains of eastern China force the Changjiang into a narrow channel that contains a series of small inner basins with a mild climate but limited level land for agriculture. Most life focuses on the river, transportation, and light industry.

There are three distinct gorges to pass through before the river debouches into the area known as eastern China. It is the final downstream gorge that has become the site for the controversial Three Gorges Dam. The area is designated ultimately to form a separate province (Sanxia or "Three Gorges").

*Liang Hu* (Two lakes, Poyang and Dongting): Once past the Three Gorges, the Changjiang enters what has been called "China's rice bowl," so named because of its abundant production. Stretching more than 630 mi (1,000 km), it is an area of many small and two large lakes, and because three other rivers enter the river here, it is prone to flooding. Historically, the basis for natural flood control was the fact that the two large lakes (Dongting and Poyang) could absorb the floodwaters. For example, Poyang Lake rises 36 ft (11 m) during the wet season. Dongting Lake expands to more than three times its dry season size and is more than 33 ft (10 m) deeper during the summer rains. This area supports immense agrarian and industrial populations and is a major east-west as well as north-south junction for transportation in all eastern China.

*Dabie Mountains:* The last CHOKE POINT for the Changjiang before it makes a final surge to the sea is created by the Dabie Mountains. The area is unsuitable for damming, but it still creates a constriction that often holds the river's high waters in the central basins, causing flooding. Were it not for the large lakes of Hunan and Jiangxi provinces, which can absorb much of these high waters, the entire area would have remained a lake or swampy area.

*Nanjing to Shanghai:* Between the one-time southern (*nan*) capital (*jing*) and Shanghai, the Changjiang has its greatest volume and flow. This section is wide and deep and has long been a kind of inland shipbuilding and port area. The area south of the river is largely mountainous and forest covered (thus providing timbers for boat building) and has a mild subtropical climate ideal for tea and citrus fruits, all of these being longtime specialties.

Today, Shanghai, at the mouth of this great river and despite its swampy physical geography, is China's largest and most modern city. It soon will replace HONG KONG as China's most international city, and the Changjiang will become one of the world's most important industrial arteries.

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## Chechnya

CHECHNYA IS A constituent republic of the Russian Federation, situated on the northern slopes of the CAUCASUS MOUNTAINS. Since the early 1990s it has been partially controlled by rebel groups who have attempted to proclaim a separate Chechen republic. The conflict between the Russian government and Chechen separatists has now lasted over a decade and has claimed an estimated 150,000 lives. Although the surface issue of the conflict is nationalist and religious identity, a more serious issue lies beneath and ensures that the conflict will continue: the presence of oil and the location of Chechnya in the middle of one of the region's major pipelines.

The Chechen Republic occupies the middle portion of the Terek River Valley, which rises in the Caucasus Mountains and flows east into the CASPIAN SEA. The southern portion of the country rises sharply to the Front Range of the Caucasus, culminating at the area's

tallest peak, Tebulosmta (14,734 ft or 4,492 m), while the northern part of the country descends to the dry lowlands of the Nogay Steppe. Chechnya's capital and main city is Grozny, located on the Sunzha River, in a narrow valley between two ridges that run parallel to the Caucasus. Much of the city is in ruins. Many of Chechnya's oil fields are located right in Grozny, or close by. The city also has a number of mineral springs. The other major river in Chechnya is the Argun, which flows down from the Caucasus heights and joins the Terek near the city of Gudermes, another major oil-field. Major pipelines run across the northern part of the country, following the Terek Valley.

The Chechens were formerly linked with their neighbors to the west in the Chechen-Ingush A.S.S.R. Today, a separate Ingush republic borders Chechnya to the west, along with the autonomous republic of North Ossetia, the Russian *krai* (district) of Stavropol to the north, and the autonomous republic of Dagestan to the east. To the south, Chechnya shares a remote border with GEORGIA, high in the Caucasus Mountains. The republic covers about 6,747 square mi (17,300 square km) and contains roughly 1 million people, the largest ethnic group in the North Caucasus. They call themselves Nokhchi and share linguistic traits with other Caucasian peoples.

Most Chechens are Muslims, and much of their history is affected by their relationship with other Islamic peoples in the region. Traditional Chechen society was clan-based, similar to highland peoples in other parts of the world, but a common identity was forged through some of the longest colonial struggles in world history, defying incorporation into the Russian Empire for nearly a century. Fierce resistance continued after formal annexation in 1859, inspiring romantic visions of heroic mountain rebels in Russian literature and art.

The Soviets, too, had their struggles with the Chechens, culminating in the forced deportation of nearly the entire nation to Central Asia and Siberia after World War II. The Chechens were allowed to return home under the Khrushchev administration, which also attempted to bring technological and industrial advances to the region for the first time. The Chechen capital of Grozny soon became one of the centers of the Soviet oil industry. By the 1990s, it is estimated that Chechnya produced 4.2 million barrels of oil a year, and refined another 18 million, contributing up to 6 percent of the gross domestic product for the entire Soviet Union.

A major pipeline was built to transport oil from Baku and the Caspian Sea to Novorossiysk and other

ports on the BLACK SEA for export. Since 1994, this business has almost entirely collapsed.

Chechnya is linked politically, economically, and culturally to RUSSIA. And although much of the country is under the control of either the self-proclaimed Chechen Republic of Ichkeria (recognized by no other nation), or independent regional warlords, it is estimated by both pro- and anti-Russian news sources that most Chechens support autonomy but not independence from the Russian Federation.

Since 1999, fighting has broken out again, this time in connection with pan-Islamicist movements in Dagestan, and possibly with global terrorist organizations, though the extent of this connection is speculative. Much of the shattered economy is run by organized criminal gangs, and a large part of educated Chechen society has left for Russian cities.

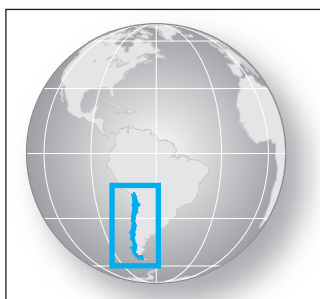
A referendum sponsored by Moscow in March 2003 approved a new constitution granting autonomy but it stipulated firmly that Chechnya remain a part of Russia. Tensions were not calmed by this move, and they escalated further with the assassination in May 2004 of the Moscow-backed Chechen president, Akhmat Kadyrov. The former president, Aslan Maskhadov, barred from the elections of 2003, now heads the separatist movement and has stated that he has enough men, arms, and resources to continue the fight against Russia for many years to come.

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## Chile

**Map Page** 1141 **Area** 302,778 square mi (756,950 square km) **Population** 15.2 million **Capital** Santiago **Highest Point** 22,573 ft (6,880 m) **Lowest Point** 0 m **GDP per capita** \$4,200 **Primary Natural Resources** copper, fish, agricultural products.



CHILE IS A LONG and narrow country in South America, about 3,999 mi (6,435 km) long and an average of 112 mi (180 km) wide. From west to east, the country is divided in three distinctive geographical spaces: the Pacific coast, the intermediate depression (*depresión intermedia*), and the ANDES.

A mountain range known as the Cordillera de la Costa (Mountains on the Coast) separates the coast from the intermediate depression. The ocean has abundant natural resources, the southern intermediate depression has rich soils, and the Andes has provided essential hydraulic (rivers that flow from east to west) and mining resources, and has had a crucial effect on the climate. In addition to its South American territory, Chile has rights to parts of the Antarctic continent and island territories off its coast in the PACIFIC OCEAN (most notably EASTER ISLAND).

### NORTH TO SOUTH

From the far north to the extreme south, Chile has a large variety of climates, environments, natural resources, and vegetation. The Great North (Norte Grande), what today includes the regions of Tarapacá and Antofagasta, was incorporated to the country following the War of the Pacific (1879–83) against BOLIVIA and PERU. This region includes the Atacama Desert, one of the driest deserts in the world, and with the exception of a few oases, the environment is extremely harsh, water resources are limited, and vegetation is scarce. The principal cities are located along the coast, where there is also an important and growing fishing industry. The interior and the northern Andes are rich in mineral resources. Nitrate was exploited between 1880 and 1930s. In the 1930s, large-scale copper replaced nitrate as the most important Chilean export. Today, the mine of Chuquibambilla continues to be the largest open-pit mine in the world.

South of the Great North lies the regions of Atacama and La Serena. The environment is less extreme, and the presence of rivers and valleys facilitates the development of small-scale agriculture. These regions have also been important for small-scale mining. To the east, the skies are particularly clear, attracting astronomers and space scientists from all around the world.

Despite the efforts of decentralization, the center of Chilean political, social, and industrial life continues to be the Central Valley. About 70 percent of the population lives in the Central Valley (which includes the regions of Valparaíso, O'Higgins, and Maule and the





A third of the population of Chile lives in the capital city, Santiago, where environmental problems affect the populace.

Metropolitan or capital region). As with many other Latin American capitals, Santiago suffers acute problems of atmospheric pollution and congestion. The central valley has a Mediterranean CLIMATE and rich soils, favoring the development of agriculture. Today, fruit and wine have become important commodities.

Abundant rainfall and vegetation characterize the southern provinces. Fishing, agriculture, and livestock have been among the most important economic activities. The city of Concepción, the third-largest city in the country, has substantial industrial activity, making a pole of development and growth in the south. South of Concepción and the the Bío Bío River lies La Frontera, which until the 1870s under the control of the Mapuches, native Latin Americans who had successfully resisted Spanish colonization. Today, the Mapuches are still struggling to recover their land and be recognized as a distinctive ethnic group in the country. Further south lies the lake region. Settled by German immigrants in the mid-19th century, its amazing beauty, lakes, and volcanoes have made it a favorite tourist destination.

While a third of the national territory lies south of the city of Puerto Montt and the Seno de Reloncaví, it has only about 3 percent of the country's population. Poor transportation has made communication difficult.

Only in 1988, the country inaugurated the Southern Highway, a 683-mi (1,100-km) road that joined Puerto Montt and Puerto Yungay. Historically, the city of Punta Arenas has been an important port strategically located in the Strait of Magellan. Today, the region of Magellan is also important because of the petroleum industry.

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## China

**Map Page** 1120 **Area** 3,645,468 square mi (9,596,960 square km) **Population** 1,298,847,624 **Capital** Beijing **Highest Point** 29,035 ft (8,850 m) **Lowest Point** -505 ft (-154 m) **GDP per capita** \$5,000 **Primary Natural Resources** coal, iron ore, petroleum, natural gas.



CHINA IS ONE of the largest countries in the world, with more than 3.6 million square mi (9.6 million square km) of land stretching from the PACIFIC OCEAN in the east to the towering glacial summits of the HIMALAYAS and Karakorum mountains in the west. From north to south, this Asian giant covers more than 30 degrees of latitude, extending from the edge of Siberia southward into the tropics near VIETNAM. Traveling from east to west, the land rises in a series of steps from the coastal zone of the North China Plain to the top of the world on the TIBETAN PLATEAU.

The country's terrain is diverse, with vast deserts, stands of forest, numerous mountain ranges, major river basins, high plateaus, extensive GRASSLANDS, and rich plains. On and below the surface, the land has extensive reserves of natural resources that provide the nation with enormous potential wealth. China ranks first in the world in population (1.3 billion), equal to 22 percent of the world's total. The population is as varied as the landscape. The Han are the most numer-



ous of the 56 recognized nationalities, accounting for 92 percent of all Chinese. China has borders with North KOREA to the east; MONGOLIA to the north; RUSSIA to the northeast; KAZAKHSTAN, KYRGYZSTAN, and TAJIKISTAN to the northwest; AFGHANISTAN, PAKISTAN, INDIA, NEPAL, Sikkim and BHUTAN to the west and southwest; and Vietnam, LAOS and MYANMAR to the south. Across the seas to the east and southeast are South KOREA, JAPAN, the PHILIPPINES, BRUNEI, MALAYSIA, and INDONESIA.

Politically, the country is organized as a republic and divided into 21 provinces, 5 autonomous regions, and 4 special municipal districts. The president serves as the head of state, the Communist Party, and the army, with a prime minister supporting as the head of government. In addition to the president and prime minister, leadership is managed through the People's Congress, which provides popular representation, and a Communist Party Standing Committee, which provides direction and leadership.

China now has 668 cities, of which 13 have populations of more than 2 million and 24 between 1 and 2 million. SHANGHAI is the largest city by urban population with 14.7 million at the end of 2003. The other major cities are BEIJING, Tianjin, Chongqing, Xi'an, Wuhan, Guangzhou, HONG KONG, Chengdu, Shenyang, and Shenzhen.

## GEOGRAPHY

China's topography started forming millions of years ago as the Indian landmass (plate) pushed northward into Eurasia, raising the landscape higher and higher and forming the Qinghai-TIBETAN PLATEAU. Often called the roof of the world, this plateau averages more than 9,840 ft (3,000 m) above sea level and includes most of the world's highest mountains. As a result, China's terrain descends in a series of steps from west to east.

The second step includes the gently sloping Inner Mongolia Plateau, the Loess Plateau, the Yunnan-Guizhou Plateau, the TARIM BASIN, the Junggar Basin and the Sichuan Basin, with an average elevation of between 3,000 and 6,000 ft (1,000 and 2,000 m). The third step, dropping to 1,500 to 3,000 ft (500 to 1,000 m) in elevation, extends eastward from the Greater Hinggan, Taihang, Wushan, and Xuefeng mountain ranges to the coast of the Pacific Ocean. Throughout this zone are China's major agricultural plains, the Northeast Plain, the North China Plain, and the Middle-Lower Changjiang Plain.

Mountains represent a major feature of China's physical geography, with mountains and associated

plateaus and hills accounting for about 65 percent of the country's landmass. Within this mountainous setting are 90 percent of China's forests, 77 percent of its pastures, 76 percent of its lakes, and 98 percent of its hydropower resources.

With a mountainous topography, distinct vertical zonation, and a monsoon-oriented weather regimen, it is no wonder that China has over 1,500 rivers. Most of the major rivers have their source on the Qinghai-Tibet Plateau and drop rather dramatically during the first third of their course. China's many rivers can be categorized as exterior and interior systems. The catchment (drainage) area for the exterior rivers accounts for 64 percent of the country's total land area.

The Yarlung Zangbo River in Tibet, which ultimately empties into the INDIAN OCEAN, boasts the largest canyon in the world, the Yarlung Zangbo Grand Canyon at 131 mi (504 km) long and 19,700 ft (6,009 m) deep. The catchment area for the interior rivers that flow into inland lakes or disappear into deserts or salt marshes makes up about 36 percent of China's total land area. China's longest inland river, the Tarim (1,300 mi or 2,179 km), flows from west to east across the northern edge of China's greatest desert, the Taklamakan, before disappearing into the sands near Lop Nor, a large inland lake that looks a lot like a human ear if you see it from space.

With headwaters high in the Tibetan Plateau, the CHANGJIANG (Yangzi) at 3,900 mi (6,300 km) is the longest river in China and in all of Asia. It is also the third-longest river in the world, next only to the NILE in Africa and the AMAZON in South America in length. With a catchment basin of more than 700,000 square mi (1.8 million square km), its BASIN is more than twice as large as that of the HUANG (Yellow River). Also known as the "golden waterway" in its upper reaches, the Changjiang serves as an important trade and transportation route from Sichuan Province to the sea.

The second longest river in China is the HUANG (Yellow) River with a length of 5,464 km (3394 mi). The Yellow River valley was one of the birthplaces of ancient Chinese civilization. It has lush pasturelands along its banks, flourishing agriculture and abundant mineral deposits. The Heilongjiang is the largest river in north China, of which 1,925 mi (3,101 km) are in China. The Pearl River (Zhujiang), 1,376 mi or 2,214 km long, is a major river in south China. In addition, China has the most famous man-made river in the world—the GRAND CANAL, which runs from Hangzhou in Zhejiang Province in the south to Beijing in the north. Work on the Grand Canal began as early as the



*For centuries, the Great Wall has served as a barrier between Inner China and the less hospitable Outer China.*

5th century, but many of its most important extensions (to Beijing) occurred under the Mongols of the Yuan Dynasty. The canal links five major rivers: the Haihe, Huang, Huaihe, Changjiang and Qiantang, and with a total length of 1,100 mi (1,801 km), is the longest and oldest man-made waterway in the world.

China has 507,000 square mi (1.3 million square km) of cultivated lands (about 9 percent of the world's total), distributed primarily in the Northeast Plain, the North China Plain, the Middle-Lower Changjiang Plain, the Pearl River Delta, and the Sichuan Basin. The fertile soils of the Northeast Plain, the largest plain in China, have a dark black color and used to produce

wheat, corn, sorghum, soybeans, flax, and sugar beets. The brown soils of the North China Plain just to the south are planted with wheat, corn, millet, and cotton.

The terrain of the Middle-Lower Changjiang Plain is noticeably flat and particularly suited to paddy rice. Because the area's abundant lakes and rivers are used extensively in freshwater fish farming, this part of China has the distinction of being called the "land of fish and rice." The area also produces large quantities of tea and silkworms, both key factors throughout China's long economic history.

The soils in the Sichuan Basin, an ancient dried-up lakebed in the upper Changjiang Basin, have a reddish tint that has given rise to the basin's other name, the Red Basin. Because the climate of the basin is warm and humid, this "land of plenty" is green with crops in all four seasons, including paddy rice, rapeseed, and sugarcane. The Pearl River Delta along the southeast coast near Hong Kong abounds with paddy rice, gathered two to three times every year.

Forests cover approximately 621,000 square mi (1.6 million square km) of China, spread throughout the mountain ranges of the northeast and in southwest China, particularly Yunnan Province. Because Yunnan is crossed by the TROPIC OF CANCER along its southern edge, it is often called the "kingdom of plants," especially at Xishuangbanna in the very southwest corner, where a rare tropical broadleaf forest plays host to more than 5,000 plant species.

Grasslands in China cover an area of 1.6 million square mi (4 million square km), stretching from the northeast to the southwest. They are the centers of animal husbandry. The Inner Mongolian Prairie is China's largest natural pastureland, and home to the famous Sanhe horses, Sanhe cattle, and Mongolian sheep. The important natural pasturelands north and south of the TIAN SHAN MOUNTAINS in XINJIANG are ideal for stock-breeding.

China is rich in mineral resources, and all of the world's known minerals can be found here. To date, geologists have confirmed reserves of 158 different minerals. These include 10 energy-related minerals, including oil, natural gas, coal, and uranium; 54 metallic minerals, including iron, manganese, copper, aluminum, lead and zinc; and 91 nonmetallic minerals.

## REGIONS

One of the easiest distinctions to make is that between Outer China and Inner China. Surrounding China on the north and west is a series of lands that have for centuries been "beyond" the Wall (Great Wall). Lands

where water and rainfall are scarce and animal husbandry takes precedence over crops. Lands where the soils are rocky and sandy, where altitude keeps the earth frozen for much of the year, and where treeless plains stretch beyond the imagination. It is also a land that drains to the interior of the continent and not to the sea.

These lands beyond the Wall are extremely remote and generally inhospitable. Where human habitation has taken hold, in those areas where the soils are more protected and water is sufficient for some form of agriculture, the peoples tend to be non-Chinese with traditions and connections to history and geography far removed from those of China's core peoples. Because this landscape provides so little (if anything at all) in the way of natural support for the traveler or an invader, it has always served as a natural buffer between China proper and the outside world and a way for the Chinese to choose where and when they meet the outside world. For this reason, the area has typically been poorly connected with the rest of the country, a historical design that has proven to be a major obstacle to development as China begins the 21st century.

## OUTER CHINA

Outer China consists of much more than just Tibet, the first area that most foreigners recognize or think of as being outside of China proper. The area also includes the Inner Mongolian and Xinjiang Autonomous Regions, plus Qinghai Province. Gansu Province and the Ningxia Autonomous Region could also be included. It is a vast area, covering some 2 million square mi (5 million square km), slightly more than 53 percent of the country's total land area. That means that if you just considered Outer China alone, it would be the seventh-largest country in the world, an area 10 times that of FRANCE.

Within this landscape are some 50 million people, a number that is large by any standard other than China, where it represents only 4 percent of the population. This empty landscape is empty for a reason; The land just cannot support large numbers of people. And where it can support life, it does so best with grazing animals and animal husbandry.

Inner Mongolia (23 million people) and Xinjiang (19 million people) are clearly the most prosperous of the region's four-plus administrative divisions, with most of the limited arable land. But the prosperity associated with these pockets of development is far from uniform. In spite of the fact that we have chosen to group these lands together under one heading, they are

so distinctive individually that it is valuable to give each a little extra attention before moving on.

The Inner Mongolian Autonomous Region (one of five such regions in China) is part of the great Mongolian Steppe (lands of Genghis Khan and the Mongol horde), a plateau region that averages about 3,280 ft (1000 m) above sea level and extends from China's border with Russia in the northeast to the deserts of Xinjiang in the northwest. Most of the land is covered to some degree by grass, although there are areas of woodland and forest in the extreme northeast, an incredible wetland region (Edsin Gol) with millions of birds and horses in the middle, and two significant deserts, the Ordos and the GOBI. But the grasses are not guaranteed, having come and gone with changes in climate over the centuries, and making a living off of the land in any one location is less than certain. It is only under the more recent Chinese occupation that cities have even existed, being of little use to the nomadic Mongols, who saw the entirety of the Earth as common ground for their herds.

Today, the region's landscape reflects far more of what has come to be seen as a modern view of development. The area's capital is in Huhhot, a thriving university and manufacturing center just seven hours or so to the west of Beijing. Baotou, just a little further to the west and near the big bend in the Huang River, serves as one of China's major industrial centers for steel and coal production. Although most of the area's residents live in more modern apartment-style housing, it remains common to see Mongol-style circular white tents (*gers*) across the landscape as you move away from the village and town region along the region's southern border with the Great Wall.

Of the area's 23 million residents, 84 percent are Han Chinese, a majority of whom live in the few agricultural zones near the Great Wall or in one of the manufacturing or mining centers. The remaining 16 percent of the population is mostly Mongolians, making the region one of only seven administrative divisions in China where the Han concentration is less than 90 percent.

Moving west from Inner Mongolia, the land gets higher and drier, and the ground has more rocks as we enter the Gobi (literally "rocky desert") until we come to Xinjiang, another of China's autonomous regions. Xinjiang is quite large, roughly three times the size of France but with only 19 million people. Like Inner Mongolia, most of the population lives in a few major cities and around the oases near the Tarim River. The largest city is the region's capital Ürümqi. Another



major city, Kashi (old Kashgar), at the far western end of the basin, served as China's front door along the SILK ROAD for more than 2,000 years. It is also the most distant place on Earth from any ocean. If you were to look down from space, you would see Xinjiang as a group of great desert basins (the Tarim and Dzungar), a smaller basin with the lowest point in China (the Turfan Depression at -505 ft or -154 m), and a towering chain of mountains (the Tian Shan or "Heavenly Mountains") running through the middle. But overall, your impression would be best described using words like *dry*, *barren*, *rocky*, and *sandy*. Because the area contains several basins, there is some water, but most of it disappears into the sands.

The region boasts China's longest inland river, the Tarim (1,300 mi or 2,100 km), flowing from west to east across the northern edge of China's greatest desert, the Taklamakan, before disappearing into the sands near Lop Nor, a large inland lake that looks a lot like a human ear if you see it from space. The Taklamakan Desert in the heart of the Tarim Basin has been famous for centuries because two routes of the Silk Road passed from oasis to oasis along its northern and southern edges. Based on the tales of travelers who heard mysterious noises coming from beyond the high desert dunes or who ventured off the regular path never to return, the local name for this great sand basin translates roughly into "you go in and you don't come out."

The population of Xinjiang has many Turkish-speaking Muslim people similar in culture and language to their counterparts in nearby Soviet Central Asia. The Uigurs (7.2 million) are the most numerous of these groups, and can be found throughout the productive oases. There are also important numbers of Kazakhs in northeastern Xinjiang, and the Kirghiz, who occupy the high mountain pastures of the south-west near Afghanistan.

In the last 20 years, major coal, oil and gas discoveries have been made, but the lack of effective modern infrastructure and lack of transportation connectivity with China's eastern seaboard has made extensive exploitation less than ideal. There are also significant deposits of minerals, especially gold, but as with oil and gas, no serviceable market nor infrastructure to support exploitation. There was a major cotton industry in Xinjiang, but the recent drop in world market prices has caused the government to institute a plan reducing production by 25 percent each year for the next several years. In addition to the railroad from Urumchi to Lanzhou in northwest China, new roads have been

constructed along historic caravan routes, connecting the regional capital of Urumchi with the oil field at Karamai, the ancient town of Kashgar (Kashi), and towns near the Soviet border.

Say "Tibet" and a million different images come to mind. If Xinjiang is famous for its deserts, long forgotten desert cities, and tales of singing maidens hiding in desert sands, Tibet is mysterious as the land beyond the snow, the roof of the world, and more recently thanks to Hollywood, the idea of Shangri-la, that perfect peaceful place where people live forever and there are no wars or conflicts.

This incredibly high, frigid landscape is among the world's most inhospitable places. The land called Tibet (Xizang to the Chinese) is part of a great plateau pushed up as the Indian subcontinent moved into the Central Asian land mass. It is a remarkable highland region that is almost everywhere above 9,840 ft (3,000 m). While the land has wide undulating platforms, numerous snow-capped mountains, glaciers that drain into dozens of long deep valleys, and hundreds of small salt lakes, we as outsiders associate far more with the region's borders that ring with the names of the world's most famous mountain ranges; the Himalayas with the highest mountain on Earth, Mt. Everest (Qomolangma) at 29,028 ft (8,848 m), and the Karakoram, home of the second-tallest mountain, K2, at 28,250 ft (8,611 m). On the southern and northeastern periphery, several of the world's great rivers (Mekong, Changjiang, Huang, Indus, IRRRAWADDI, Salween, and Bramaputra) find their sources.

But aside from all this geographic wonder including Mt. Everest, it is generally Lhasa, Buddhism, and the Dalai Lama that give outsiders a geographic hold on the landscape. These highland peoples have historically been yak herders and nomads, with marginal farming limited to the broader valleys such as the one at Lhasa, where concentrations of people give the area a sense of place. Buddhist monasteries have been at the center of society here for more than 2,000 years, organized by a landowning theocracy dominated by monks. Following contact with the Mongols, the theocracy came to be headed by a Dalai Lama, with the incredible Potala Palace in Lhasa as headquarters. So significant has been the role of religion in Tibet that until the 1950s, one out of every five Tibetans was a Buddhist nun or monk.

Since the early 1950s, the Chinese government has encouraged in-migration by farmers and others, both to stimulate agricultural production and economic development and increase Han presence. But the region's



remoteness and lack of connectivity to other areas in China has greatly limited most of these development efforts. At present, a major railroad line is being built across the frozen Tibetan wastes to Qinghai, where it will connect with the main east-west line to Lanzhou and then eastern China.

### THE SOUTHWEST

Located in extreme southwest China, the provinces of Yunnan and Guizhou could easily be considered part of Outer China, for the area is remote, disconnected from China's core, and populated by minority peoples. But the geography is such that it is a special region unto itself, with major dissimilarities in the core conditions that make it such a unique and interesting place. Just for a reference, you can generally consider the southwest as being south of the Changjiang, with borders with Myanmar, Laos, and Vietnam to the east and south.

Conceptually, the area could be grouped with Outer China in the sense that the high, rugged terrain of the Yunnan-Guizhou Plateau, with its rushing rivers, steep slopes, and lack of connectivity, served as a formidable barrier to entry into China's interior lands. But the region has a long growing season, adequate rainfall for agriculture to exist where the soils are favorable, dense forestlands, and since 1949 improved road and rail connections with the rest of China. The region also grows rice, something we do not see in the dry climate regions that make up the traditional nomadic-pastoral landscape of the four areas in Outer China.

Scattered throughout the plateau are numerous small plains and valleys, called *batze* by the locals, where many of the minority populations live and where agriculture is productive enough to support the 81 million people who now call the area home. But the area's basic remoteness from China's core, mild climate, good rainfall, and adequate food have given the people a laid-back attitude in stark contrast to many of China's other regions, where the pressures of excessive population and inconsistency in food production have made life more problematic until recently.

What is interesting about the southwest is that it is the physical geography that stands out without a dominant place or places around which we could typify the region with a label. And while there are plenty of cities to visit today, they tend to be lost in a landscape whose scenery is rich in picturesque limestone hills with precipitous slopes and overhanging cliffs, beautiful spired columns, giant sinkholes, and caverns with large sub-



*The Chinese landscape varies from frigid mountains to the more tropical yet unique locales (above) in the south.*

terranean rivers often crashing their way through unbelievable rock formations.

In the extreme south where the TROPIC OF CANCER cuts through the southern edge of the plateau, the area boasts tropical forests, banana plantations, elephants, and a host of other jungle creatures unique to all of China. In contrast, you can move to the far northwest and the clouds and mist hide towering 20,000-ft-(6,000-m)-plus glacial mountains and hidden green valleys straight out of the Shangri-la in James Hilton's *The Lost Horizon*.

Both Yunnan and Guizhou have rich minority cultures that make up roughly 35 percent of the population. Of the 43 million people in Yunnan (15 million of whom live in five cities), the Bai, Hani, and Dai are the most numerous, while among Guizhou's 38 million people (with 16 million in four cities), the Miao are the most prevalent.

Yunnan is the most distinctive of China's provinces in that it is home to 20 of the 55 recognized ethnic minorities, something you feel immediately when there. As with the other outer regions, the Han population in the southwest is far less than the 92 percent they average for the country as a whole.

Despite the region's relatively poor soils, important quantities of corn, sweet potatoes, and barley are also produced in the interior valleys and plains. The area is also becoming known as the tobacco capital of China, thanks to the large quantities of tobacco now grown

throughout the plateau's interior hill country and a host of new cigarette manufacturing facilities. Kunming, the capital of Yunnan, is a remarkably cosmopolitan city of 4.5 million, while Guiyang, with 3.4 million people, is the administrative center of Guizhou.

Both were extremely important centers during the Japanese occupation of China in the late 1930s and early 1940s, and both have had significant contact with Westerners over the years. Kunming, in addition to being an important center along the old Burma Road, even served as a base for American flyers (the Flying Tigers) transporting goods during World War II. Aside from agriculture and tobacco, the region has extensive deposits of tin, followed by copper, zinc, and phosphorous.

### THE NORTHEAST

Located in the northeastern corner of China, between the Great Wall and the Russian and Korean borders, are three more provinces whose character has had a long history with China, particularly under Kublai Khan's Yuan Dynasty. China's northeast, or old Manchuria, consists of three provinces, Heilongjiang, Jilin, and Liaoning. Unlike the other lands to the west that are also beyond the Great Wall, the region was subject to Chinese expansion as far back as the 3rd century B.C.E., an expression of the agricultural potential of the Northeast (Manchurian) Plain that occupies the heart of the region.

Today, the region is the most important heavy industrial center in China. It is also one of the more important centers for industrial crops such as soybeans, sugar beets, peanuts, and potatoes in addition to commercial grains such as wheat, corn, and millet. There are significant quantities of coal. Commercial quantities of iron ore exist, but most of it is low to mid-grade. The region also has sizable reserves of molybdenum, copper, lead, zinc, graphite, and bauxite. As China's middle class continues to grow, so has the demand for recreation facilities and resorts.

The heavily forested Hingan Mountains to the west also provide major quantities of timber products in addition to serving as recreational hunting and fishing areas. Because the mountains in the northeast receive significant amounts of snow, the area is also becoming the skiing center of China, with major resorts opening in the mountain areas near Harbin and Jilin. With a combined population of 105 million, the northeast accounts for a little more than 8 percent of China's population, 8 percent of the total land, and interestingly, an 8 percent minority population. But the minority

concentrations get smaller each year with continued immigration by the dominant Han.

### THE NORTH CHINA PLAIN

The North China Plain holds a fascinating presence within the Chinese landscape. It is a special place where history and geography have truly worked together in shaping both the region and the nation as a whole. It is also very clearly a region where the history has also shaped the land. Yes, the region is rich agriculturally, particularly in the central portions where the flat delta plain of the Huang (Yellow) River has provided a broad well-watered setting on which to grow crops for millennia. The landscape is also old in terms of human contact, with archaeological findings such as Peking Man indicating that humans have been in the area for more than 500,000 years. The area is also old intellectually; great philosophers such as Confucius and Mencius expounded their theories on good government here some 2,700 years ago. But of the many geographic features worth describing, none seem equal in dominance to that of Beijing, the region's major city and the nation's capital. It is Beijing and its geography that have so defined what we see today; maybe even for China as a whole.

With a resident population of 11.6 million, Beijing is the center of political power in China. To the casual observer, Beijing could easily be mistaken as another typically cosmopolitan world capital. But the city has had a long relationship with the sea, thanks to the Grand Canal, another of those Mongol creations whose lasting impact is beyond description.

Beijing works closely with the neighboring port city of Tianjin (9 million) less than 100 mi (160 km) away. Although they are separate entities, they should not be considered alone. With a combined population of more than 20 million, independence as national municipal districts, the support of the central government, historic connections to the outside world, and strong connectivity through roads, railroads, and water canals, these two northern giants represent a major driving force within the Chinese landscape and the world.

With Beijing serving as host city for the 2008 Olympics, intense efforts are under way to extend both the city and region's base as the premier economic center in China. The North China Plain is also home to many of China's most recognizable cultural attractions. Among these, the Great Wall at Badaling, the Forbidden City, the Temple of Heaven, and the Summer Palace are World Cultural Centers.

While many foreigners might think Shandong Province is best known for Tsingtao beer, the area contains the home of Confucius and Mount Tai, one of the five sacred mountains in China. To the south in Henan Province are the old capitals of Luoyang and Kaifeng along the banks of the Huang, as well as the mountain stronghold home of the Shaolin monks whose mysterious martial-art form, Wushu (Kungfu), has been turned into countless box office action dramas.

Today, the administrative regions within the North China Plain contain only 5 percent of China's land but have 22 percent of the population. This rather lopsided ratio is possible because the region also has 35 percent of the nation's cultivated land. After centuries of silt deposition from the Huang, the region is covered with a dense carpet of agricultural fields. Although the climate is too cold for rice, the fertile soils are planted with crops such as winter wheat, barley, millet, and sorghum (*kaoliang*).

### THE LOESS PLATEAU

For more than 80 centuries, Chinese farmers have lived and worked on lands of the Loess Plateau. During this time the untold battles and conflicts that occurred shaped a different kind of China. Located in north-central China, the region was the heart of China's first unification as an empire and in some ways a cradle for the great agricultural civilization that followed. Near the outland wastes of the deserts of the far west and the stony steppe of the Mongolian Plateau to the north, this landscape served for more than 10 centuries as China's frontier fortress against foreign aggression.

It is in this capacity as a stronghold against aggression that allows it to be described as a cradle (protector) of China's agricultural civilization. It is also in this capacity and during this specific time that the coevolution of the physical and human Chinese landscapes began. For much of this geographic interplay, few geographic factors stand out more than the area's isolated setting (at the time) and distance from the agricultural core.

But its distance from the heartland and the poor agricultural conditions offered by the Loess Plateau soils were constant challenges to emperors needing to feed an army sufficient to defend the realm. While the LOESS is rich in calcium and thus fertile, the overall aridity of the region coupled with the fact that loess does not hold water makes traditional methods of irrigation and farming useless.

As a result, much of the area has been heavily dissected into "badlands," with rugged hills and gullies

standing out in the landscape, a solemn testament to centuries of repeated misuse and overuse, particularly where there has been extensive cultivation (including terracing) and overgrazing on sloped terrain. The result was that the early Chinese dynasties had to rely on the agricultural heartlands to provide food. It is this extreme cost in food resources that constantly taxed the Chinese system and led to years of internal strife and the possibility of revolt.

Today, the region includes the provinces of Shanxi and Shanxi and maybe even parts of Gansu and Ningxia, but thinking of it as Xi'an and the big loop of the Yellow River is not far wrong. Despite the challenging environment, the region's 70 million people are evenly distributed, following nearly 50 centuries of occupation. The land remains poor agriculturally, and farmers seldom expect to harvest more than two crops every three years. There are still thousands of people living in underground houses dug out of the ground, something the region is particularly famous for.

While severely challenged agriculturally, the region has a wealth of major mineral resources, including vast quantities of coal and natural gas that are only now being exploited as the government works to expand infrastructure in the region. The Huang flows both around and through much of the landscape. But unlike the Changjiang, the Huang freezes in winter and can be navigated only by very small boats and rafts in most locations. There have also been more than 1,500 floods and 26 course changes recorded on the Huang He's journey to the sea during the past 3,000 years. And with each inundation, whether by flood or change of course, there have been heavy losses in lives and property, lending credence to the river's other name as the "River of Sorrow."

### MIDDLE CHINA

Think of middle China and the first thing that probably comes to mind is the Changjiang, the Three Gorges Dam, and maybe by Shanghai and spicy Sichuan food. The words are a perfect beginning to understanding the heart of China. The Changjiang is China's greatest river. Like the Huang, the headwaters of the Changjiang are high in the Tibetan Plateau. But with a catchment basin of more than 700,000 square mi (1.8 million square km), it is more than twice as large as the Huang Basin. Because the Changjiang flows south of the Qinling Mountains, its basin is completely different from that of the Huang.

While the waters of the Huang descend through deserts, loess, and a landscape of prairie grass devoid

of trees and other vegetation, the Changjiang makes its way through a series of basins in what was formerly a region of dense tropical and subtropical forest. Because the region has been agriculturally rich for nearly 2,000 years (with triple rice harvests common), it has long formed the core of the Chinese economy and provided the surpluses in food resources necessary to support growing industrial needs. This is what the great imperial armies worked to protect.

### RIVER BASINS

The basins of the Changjiang, which link together seven provinces and two municipal-class cities, cover about 16 percent of China's land and have 38 percent of the people. The fertile, intensively cultivated lake basins near Wuhan have been called the rice bowl of China, and agricultural productivity is immense.

Population densities easily exceed 1,000 people per square mile (1,600 per square km) in places, with an urban focus on the tricity hub at Wuhan, the site of one of the newest and largest steel complexes in the country and just downstream from the massive Three Gorges Dam. The Changjiang, unlike the Huang, can be navigated as far inland as Sichuan Province, with the huge port city of Shanghai (16 million), near the river's mouth and the largest city on the Asian continent, serving as the gateway to the nation's heartland.

It is on the Changjiang plain that the transition between northern and southern patterns of cultivation occurs (the rice-wheat boundary). Although the transition separates China's cultivated area in half, only one-third of the total agricultural production lies north of the line. South of this division, irrigated rice fields spread out over the lowlands, and tea and other tree crops are planted in the hills. Taken as a whole, the rice-tea agriculture of southern China produces 60 percent of China's food supply on less than half its cultivated area. It also contains a majority of the animal population: half the cattle and two-thirds of the pigs.

The Sichuan (Red) Basin, some 1,000 mi (1,609 km) inland, is an ancient lake that dried up thousands of years ago and has since been filled by ages of erosion and river deposition. The basin is the core of Sichuan Province's 84.6 million people, two-thirds of whom live in the basin proper. Terraced slopes are planted with rice in summer and wheat in winter. At higher elevations, sweet potatoes and corn are grown, with tea and mulberry trees planted on hill slopes.

With 56 percent of the available land devoted to paddy rice, the region is one of the most concentrated rice-growing areas in the world. On the basin's eastern

border are the Wushan Mountains, a remarkably eroded limestone complex that presents a fascinating gateway landscape as you enter the Three Gorges (Sanxia) region of the Changjiang.

### THE SOUTHEAST COAST

Although the area's geography is not well known, mention Hong Kong and most people would indicate some understanding. A few more would think of Hong Kong's sister at the other end of the Pearl River, Guangzhou (old Canton), as the other major city in the area. But why? Despite China's extensive coastline, it has few natural harbors with access to the interior. The Pearl River Delta region happens to be one of the biggest and best adapted.

The region experiences three quite clearly marked seasons, and most annual rainfall falls in the long, hot summer. Temperatures are high enough throughout the year for a 12-month growing period, with rice by far the most important crop. Nearly all the rice grown is freshwater paddy and is at least double-cropped. Other important crops include sweet potatoes, corn, sugarcane, groundnuts, tea, and many other kinds of vegetables. Fruit grows in profusion in this tropical climate. Prominent are the pineapple, citrus fruits, lychee, longan, papaya, guava, banana, and persimmon. Guangdong's silk production is considerable and ranks third behind Sichuan and Jiangsu.

The Pearl River region of Guangdong Province is the heart of China's economic resurgence, with major manufacturing centers in Guangzhou and Shenzhen and outlets for international shipping through the harbor at Hong Kong. Hong Kong is also serves as the regions primary center for finance and insurance.

### MINORITY PEOPLES

China is the most populous country in the world, with 1.3 billion people at the end of 2002, about 22 percent of the world's total. This figure does not include many Chinese in the Hong Kong Special Administrative Region, Taiwan Province, and Macao Special Administrative Region. It is also a multiethnic nation with 56 ethnic groups, the Han being the most numerous, about 92 percent of the population.

The Han people live throughout the country, though mainly on the middle and lower reaches of the Yellow River, the Changjiang and the Pearl River valleys, and the Northeast Plain. Because the Han constitute the major population of China, the other 55 groups make up what are known as national minorities. Although fewer in number, they are also scattered



over a vast area, but are mainly in the border regions from northeast to the southwest. Of these, the Zhuang people from Yunnan, Guizhou, and Guangdong are the most numerous at 15.5 million.

Although the minority groups are numerous, 18 of them account for 94 percent of the minority population. Yunnan Province, home to more than 20 ethnic groups, has the greatest diversity of minority peoples of any province in China.

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## choke point

A CHOKE POINT IS ANY narrow passage that restricts traffic. It literally connotes a location where the flow could be choked off. As a military term, it refers to areas in lines of sea, ground, air or space communications (physical travel) that restrict freedom of movement by slowing and confining. This allows an adversary to focus observation, targeting, and engagement assets on a likely area of contact, which can occur at several scales both conceptually and physically at the choke point.

At the tactical level of operations, the spectrum of choke points may array from a doorway of a building, to a bridge across an impassable river, to a mountain pass of some width. As the level of operations expands, then major ports and river valleys add to the array. Globally, major straits, isthmuses, and coastal corridors may "choke" movement of men and materiel at that larger scale of operation.

Maritime strategists have used the concept of controlling choke points as a resource-efficient way to negate the near total maneuverability availed by the open ocean. Transit from world waterway to world waterway is often confined by constricted terrain, be it submerged or above sea level. The BAB EL MANDEB, Straits of Hormuz, Malacca Straits, Cape of Good Hope, Greenland-Iceland-United Kingdom (GIUK) Gap, the Straits of GIBRALTAR, and the English Channel are a short list of the many challenges to any battleship captain. Sir John Fisher, First Sea Lord of the Royal Navy may have coined the phrase "choke point." He proposed that the control of these key locations was central to the domination of the seas and consequently to the welfare of the UNITED KINGDOM.

Commercial concerns arise where natural hazards or accidents could disrupt the flow of goods, particularly oil. Oil transport by tanker is the most flexible means of transport on a global scale. Restricted to a near fixed set of maritime routes because of economic efficiencies, the tankers are vulnerable to a number of choke points. An accident in one of these restrictive passages could cause immediate disruption of commerce and significant financial loss. Be they natural (Strait of Hormuz) or man-made (Suez Canal), they pose a significant risk. However the economic effects must not be overstated in every case. The closure of the Suez Canal from late 1960 until 1975 caused the marketplace to adapt, and the advent of the supertankers brought new economic efficiency along with ecological perils.

Military and commercial operations are now dependent upon space-based assets such as navigational, meteorological, and communications satellites. The concept of choke points is equally applicable to space. Launch restrictions based on Earth rotation, orbit targets, and cargo requirements place spacecraft into a very restricted launch "tunnel" that extends from the fixed site launch facility to its orbital target. Space-based or terrestrial-based military assets could focus on this tunnel for observation and interdiction. Certain points in translunar space, known as lunar libration points, provide physical advantages of a military na-

ture. Basically objects at these locations enjoy a balance of lunar and earth gravitational pulls and can hold position effectively with low fuel consumption. These positions can contest access to and from the moon while dominating earth and moon by observation. They may constitute operational chokepoints.

The term *choke point* has gained wider usage to include any constraining aspect of an operation or process, be it military, business, or academic. It is now being applied to cyberspace when addressing network security and vulnerability.

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## Christaller, Walter (1893–1969)

A GERMAN geographer, Walter Christaller helped bring quantitative and statistical disciplines to the study of geography. Christaller was born in Berneck, GERMANY; his father was a clergyman and his mother an author. Before 1914, he attended university in Heidelberg and in Munich. He enlisted during World War I, and became an officer. Returning after the war to study, he went to the University of Erlangen, where he obtained his master's degree in 1930. His doctoral thesis was presented at the University of Erlangen in 1932 under the supervision of Professor Robert Gradmann, a specialist in settlement geography.

Christaller influenced the discipline of geography with the publication in 1933 of his book *Central Places in Southern Germany*, in which he introduced quantitative and statistical techniques for the first time in geography. Between obtaining his master's degree in political economy and conducting doctoral research, Christaller worked in jobs as a journalist and also as a miner.

Christaller's work followed several theoretical works that started in the 19th century and aimed to determine the optimal location of an economic or a geographic entity in a given environment. This followed from works by economists (Johann Heinrich Von Thü-

nen, Andreas Predöhl, William J. Reilly, August Lösch), sociologists (Alfred Weber, René Maunier), engineers (Leon Lalanne, Jean Reynaud), and a geographer (Johann Georg Kohl). Jean Reynaud had already initiated his stream of research in an article entitled "Cities" in *l'Encyclopédie nouvelle* (1841) and proposed an elaborated version of the theory of central place. The double formation of Christaller as a geographer and an economist could explain the elaborated graphics and cartographic expression in his research.

His field survey in southern Germany, which at that time stretched from the Alsace region to AUSTRIA, permitted him to develop his theory. In the 1930s, this region was little affected by the INDUSTRIAL REVOLUTION. As a result, the model postulated that the organization observed was the product of market and rural logics.

Christaller developed the idea of a space that is supposed to be isotropic, homogenous, and functioning in self-sufficiency in perfect conditions of competition from economic agents, producers, and consumers. Christaller graphically showed interests convergent with the general interest in a regulated society, representing hexagonal market areas that are fitted in each other to cover all the territory. Central places emerge at the center of each hexagon, which contained six lower-order places to ensure that goods and services are available. His model, based on a hierarchical central place system, suggests four basic premises.

First, the higher-order central places will provide all goods and services that are found at the lower-order centers. Second, larger central places will provide a variety of functions and specialized functions. Third, within a place, the number of lower-order centers will be proportional to the number of higher-order places; and fourth, the higher-order central places have greater distances between similar places compared to lower-order places, because of the exclusivity of market boundaries.

The Christaller Model inspired leaders of planning in the national-socialist state and the practices of town and country planning in several countries. Christaller could use his theory in practice with the rise of Adolf Hitler's Third Reich in Germany and its conquered territories, including a reconfiguration of the geography of Germany's eastern conquests such as Czechoslovakia and POLAND. Particularly in the priority plan *Deutscher Osten*, Christaller was in charge of planning for occupied Poland by using his central place theory. The model of central place was improved in 1940 by the economist August Lösch, who was far less inclined

to the ideas of the Reich at that time, with the introduction of theorist postulates influenced by the classic economic approach. The honors to Christaller's achievements came at the end of his life and include the Outstanding Achievement Award from the Association of American Geographers in 1964. In 1996, the Geography Award of Walter Christaller was created in Germany. This award, a reference to the international prestige of the geographer, but not as his past experience as a planner of the Reich, has fueled debates in the German geography community.

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## Christmas Island

CHRISTMAS ISLAND IS AN isolated island in the INDIAN OCEAN, located about 220 mi (360 km) southwest of JAVA, INDONESIA, and 1,400 mi (2,300 km) northwest of AUSTRALIA, to which it belongs as a dependency. Maintained chiefly as a phosphate-mining colony since the 19th century, it is now being developed as a tropical island holiday spot and as a potential launching site for the Asia-Pacific Space Center.

The island is the summit of a submarine mountain. About 60 million years ago a volcanic cone emerged, became covered in coral and limestone, and sank back into the sea, only to reemerge from tectonic uplifts about 10 million years ago. Coral reefs surround the crown of this peak. It is evident that this is the top of a mountain because there is virtually no continental shelf: the surrounding waters plummet to 1,650 ft (500 m) within 660 ft (200 m) of the shore. Sea cliffs up to 60 ft (20 m) rise straight from the sea toward a central plateau. There are a few shallow bays, the largest being

the island's only port, Flying Fish Cove, on the northeast corner. Most of the island is covered by tropical rainforest, which, since 1998, has been preserved as a national park. This park attracts visitors to its unique flora and fauna, notably the island's most famous residents, the red crab: 100 million of them crowd the forest floors. The surrounding waters are known for their varied tropical fish, spinner dolphins, and the occasional whale shark.

The island was noted in the logs of various British and Dutch explorers in the 17th century and given its name by one of these on Christmas Day, 1643. The uninhabited island was annexed by Great Britain in 1888, and some settlers arrived from the COCOS ISLANDS (560 mi or 900 km to the southwest) to collect timber and supplies. Phosphate mining began in the 1890s, with imported labor from Southeast Asia. Today's Chinese and Malay populations are descendants of these workers and are the bulk of the island's population. The island was administered as part of the Singapore Colony until 1957, when Australia bought it for £2.9 million. The mines closed in the 1980s, so Australia granted citizenship in 1984, giving its residents social services and emigration possibilities. The mine was bought by locals in 1991 and reopened on a smaller scale, but government-sponsored tourism is now the largest industry, including a casino.

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## city types

CITIES ARE INFLUENCED by a broad variety of contexts and factors, including particular groups of people. As a consequence of numerous influences, the city may, to some extent, specialize in and be characterized as being of a particular type. To refer to people and government regimes, for example, a number of particular city types can be observed, such as aristocratic, democratic, oligarchic, and dictatorial. These types of regimes can be employed to classify city types developed under their orders.

The types of specialization that occur within an urban center are widely used to classify city nature or

type. For instance, cities that contain a manufacturing industrial base are commonly referred to as industrial cities, while cities that act as markets with the buying and selling of particular goods are sometimes known as market cities or market places. Other means by which cities can be classified include art, culture, and size. Demographic size is an important criterion in the categorization of different urban places. Urban centers have consisted of an order based on population size, starting with hamlets, then progressing in size and spatial extent to villages, towns, and cities.

However, in the modern era, many cities in the world are so large and have such important functions (principally economic and political) that they are referred to as world cities. Places noted as being world cities in the past are not necessarily world cities of the modern age. Some world cities in history, such as Bruges in BELGIUM, are not world cities today because of their stagnation in size, their decline in importance, and the rise of other urban places. If the modern period is considered, world cities are principally classified by their market and industrial functions.

For example, arguably the first modern world city was LONDON, England, a settlement that grew from about one million people to over 6 million people between 1801 and 1901, as a consequence of its rapidly expanding economic base brought about by the forces unleashed by industrialization. Today, places that are considered world cities include TOKYO, NEW YORK, London, and PARIS. However, other places are also acknowledged as being significant settlements in the global context, and these places include MEXICO CITY, Sydney, Cairo, and MUMBAI—a consequence of their large size, diversity of population, international financial institutions, and stock exchanges as well as a variety of internationally known cultural institutions and landmarks.

In noting city types it should be specified that classifications vary significantly from country to country and that even within a country city types can vary. For instance, in CALIFORNIA, city types are noted according to their local governments and the range of freedoms that these municipal authorities enjoy. Thus, in California, cities are classified as being either charter cities or general law cities, depending on whether or not they operate within the framework of California municipal law.

At different times in history, cities have been developed in response to different functions and influences. One of the most significant periods of societal development was the Renaissance, and during this time a

whole new city form was developed. This new city, known as the Ideal City, was to be based on the application of a strict geometric (circular) form around which was placed a wall for defense. Notable examples of ideal cities include Palma Nuova in ITALY, although arguably the most famous, Sforzinda (designed by the architect Filarete), was never actually built. While in the context of the Renaissance the ideal urban place could be noted for its particular morphology, in subsequent times, other ideal city types were more renowned for their open, democratic, and civilizing societies. These include places such as the first garden city, Letchworth in England, which was created in 1904 as a place to create a community where the poor could live as well as the rich within a low-density environment filled with gardens and foliage.

Other modern ideal city types include Chandigarh in INDIA, the brainchild of modern architect pioneer Charles-Édouard Le Corbusier, and Putrajaya in MALAYSIA, a late-20th-century urban project to create an administrative center within the Federation of Malaysia, and thus to leave the county's capital, Kuala Lumpur, to specialize in commercial and financial activities. Following the successful development of Putrajaya, the Malaysian government created a new urban place called Cyberjaya, a new city type, a cybercity, where the world's most advanced information technology companies are to be based within a low-density, tropical-inspired landscape.

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## city-states

A CITY-STATE IS AN independent political entity composed of a large and important town and surrounding countryside. In ancient times, city-states, such as the Greek city-states and Rome, sometimes became great economic and military powers that secured far-flung empires, thereby imposing their will and culture on other civilizations. In late medieval and Renaissance ITALY, powerful trading city-states flourished such as Florence, Milan, and Venice. City-states also



existed in northern GERMANY at Bremen and Hamburg. Some contend that city-states exist today and new forms are emerging that exhibit economic power and independence if not the political sovereignty of earlier classical examples.

The first city-states were in Sumer in the fertile lower Tigris-Euphrates Valley of Mesopotamia. The open area was vulnerable to invasion, but the Sumerians found strength in their urban units. Important cities were Akkad, Eridu, Kish, Lagash, Larsa, Umma, Ur, and Uruk. Rulers of the most important Sumerian cities were periodically able to assert their control over the region.

The city-state reached its zenith in ancient GREECE. Although sometimes able to form federations to face a common foe like Troy and Persia, the Greek city-state, or *polis*, remained the form of social structure. The most significant were Athens and Sparta. Of lesser importance were Argos, Corinth, and Thebes. Within these cities, different forms of government were tried, such as monarchy (hereditary kingship), tyranny (dictatorship), timocracy (rule by the wealthy), oligarchy (rule by a few), and democracy (rule by the people [free male citizens]).

One of their greatest achievements was democracy, which until the late 18th century was believed feasible only in city-states where people could easily meet and reach community decisions. Though disunited and small in territory and population, the Greek city-states contained fiercely patriotic and creative citizens. Their cities became the cradle of Western civilization with monumental achievements in art, literature, drama, history, architecture, science, and philosophy. The Greeks spread their rich culture by founding new and significant city-states throughout the Mediterranean region. Greek colonies appeared at locations as diverse as on the shores of the BLACK SEA, present-day FRANCE, Africa, Asia Minor, Sicily, and Italy.

It was from a small city-state in Italy that the world's greatest empire arose. Legend says that the city of Rome was founded by its first king, Romulus, on the Palatine Hill on the Tiber River. The Roman Republic was born when the rule of Etruscan kings was overthrown in 509 B.C.E. Despite a vulnerable geographic position, the empire won by its energetic and ambitious citizens would be of unrepresented durability, might, and size as it stretched from Scotland to Persia.

Eventually the republic, governed by a senate, would be replaced by the rule of emperors following the rise to power of Caesar Augustus, and the city of Rome would become a crowded metropolis of tower-

ing marble structures such as the Colosseum. Wherever the Roman legions marched, they brought not only Roman rule, but law, order, economic unity, trade, and massive public works. Rome was also unique in the liberal granting of Roman citizenship to conquered peoples across the empire, but it also brought oppression and slavery. Rome's greatest contributions to Western civilization were law, public administration, urban planning, military strategy, literature, and architecture. The Western Roman Empire eventually succumbed to a slow decline, the causes of which are still debated. The Goths would depose the last emperor in 476 C.E.

The disorder of the Holy Roman Empire led to the formation of independent towns and principalities in northern Italy. The three most important city-states were Florence, Milan, and Venice. Lesser city-states included Ferrara, Genoa, Lucca, Mantua, Padua, Pisa, Siena, and Urbino. The Italian city-states, the kingdoms of Naples and Sicily, and the Papal States constantly engaged in wars and intrigues, thereby producing ever-shifting borders and alliances.

Eventually, some city-states commanded enough territory and wealth to become major European powers and centers of culture and learning as their plotting princes and ruling families helped fuel the Renaissance by patronizing the arts. Most of these city-states began with an adherence to republican ideals but degenerated into ruthless oligarchies and despotism, but often with a façade of republican institutions.

After defeating its rival, Genoa, Venice emerged the most republican and successful Italian city-state in amassing riches through trade and in avoiding the endless conflict suffered by the others. Yet the cities' sovereignty was lost in the 19th century through infighting and the inability to unite against outside aggression. The Black Death also took a horrendous toll on their dense populations.

Today, SINGAPORE ("the lion city") and HONG KONG are often viewed as modern city-states exerting enormous economic power and political independence, although the extent and future of Hong Kong's quasi-independence from CHINA is in question. Less convincingly, some contend that other large cities may develop into city-states because of their economic influence, such as LONDON, LOS ANGELES, NEW YORK, Rotterdam, and TOKYO. Yet these and other large urban centers, with international trade and ties, are firmly a part of their nation-states, with neither a prospect nor a desire of gaining the political independence or sovereignty sufficient to qualify as true city-states as traditionally defined. Nevertheless, many large cities are

gaining greater independence in managing local affairs and international economic activities.

More futuristically, some assert that “Dubai Internet City” in India is destined by design to become a completely new type of city-state for the 21st century as it strives to reach its goal of becoming an independent and principal ground base for the cyber-world economy, thus substituting communication and corresponding economic centralization for geography as defining characteristics of the city-state. Also predicting the future, some economists argue that the forces of globalization or regional economic and political unification will eventually make cities more important than nations. Some envision this happening to cities in the center of Europe, such as Lyons, Stuttgart, Milan, and Barcelona, if the EUROPEAN UNION strengthens and blurs national distinctions. Therefore, the definition of a city-state may ultimately change to reflect traditional economic independence, but with new forms of political autonomy and perhaps transcending traditional geographic boundaries.

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## civilizations, early river

Early river valley civilizations arose in Mesopotamia, EGYPT, the INDUS RIVER Valley, and CHINA. Earlier agri-cultural societies (8,000 to 13,000 years ago) were largely subsistence cultures. The river civilizations had food enough to provide for classes of people other than just farmers. These societies all used agricultural sur-pluses to establish civilizations with cities and trade and to create greater sophistication in the arts, sci-ences, government, and even a leisure class. Cities en-abled societies much more sophisticated than primitive agriculture allowed. The first beginnings of a higher-

level urban-rural society began in Mesopotamia about 4000 B.C.E. The other civilizations appeared shortly thereafter.

### MESOPOTAMIA

Mesopotamia, “The Land Between Two Rivers,” lay in the valley of the Tigris and Euphrates rivers. The rivers provided fish and birds as sources of food. More im-portant, they made agriculture relatively easy. The land lacked a dependable supply of rain, and the supply from the rivers was variable through the seasons. With careful irrigation, the water from the rivers allowed the fertile land of Mesopotamia to produce crops larger than the farmers needed to subsist. Cities do not pro-duce primary products—they refine basic materials. Cities were vital for trade, handicraft production, gov-ernment, and military defense.

Sumerian civilization dominated Mesopotamia from 3500 B.C.E. to 2000 B.C.E. It was replaced by Babylonia, then Assyria. Sumerian city-states prolifer-ated between 3200 and 2350 B.C.E., dominating their regions. Cities provided order and a mechanism for handling public projects. The cities collected the wealth of their outlying agricultural regions: barley, dates, wheat, vegetables, and livestock. City merchants traded textiles and other products for luxuries such as ivory from PERSIAN GULF peoples.

Each city had its own god. The central structure in the fortified city was the temple to the city’s god and protector. Architectural highlights include the ziggurat, a large and aesthetically impressive temple tower and house of god made of mud brick, built as a form of worship. City administration was initially by assembly, but by 3000 B.C.E., kings ruled the city-states, the sin-gle head being more efficient when action was neces-sary. The king ruled over the city and its hinterlands, which received defense in return for agricultural prod-ucts that allowed the kings to establish militaries, tax collectors, administrators, and the leisure class.

Sumerians were the first to use bronze. They also made pottery and carved stones and shells while creat-ing gold and silver jewelry. Sumerian pictographs evolved over the centuries into cuneiform. Sumer fell to the expansionist urges of Sargon of Akkad (2370–2315 B.C.E.), whose empire lasted until circa 2100 B.C.E. Babylon was a successor to Sumer, dominating until around 1600 B.C.E. Babylon used Sumerian irrigation and agricultural technology and the Sumerian calendar. Babylon developed a number system based on six and worked with perfumes, cosmetics, medicine, and phar-macology.

Hammurabi's *lex talionis* was the first written code of laws. The civilization collapsed when the Hittites invaded around 1596 B.C.E.

The third major city civilization, Assyria, was expansive. The Assyrians were immigrants who came in two waves, around 6000 B.C.E. and in 3000 B.C.E. They spread from the Tigris to the Armenian mountains in the north and the ZAGROS MOUNTAINS in the east, developing mining and forestry. Assyria established a few large cities for trade and crafts development, but it was mostly small villages with irrigated farms. Assyrians were organizers and warriors.

The Mesopotamians early on lacked systematic laws, didn't use analogy, and had limited science. But they had high-value literature, prime examples of which were the creation myth, *Enuma Elish*, and the epic, *Gilgamesh*. The *Code of Hammurabi* exemplifies the writing of law. Mesopotamia was deficient in stone and wood, which it had to import, but it had clay, which served for writing tablets as well as houses.

The religions of Mesopotamia were polytheistic, with multitudes of temples to the multitudes of gods. The beliefs would later influence the Hebrew and Greek religions. Accomplishments of this civilization included the wheel, used in carts, the arch and the dome, cuneiform writing, astrology, and a number system based on 60.

Mesopotamia was an indefensible and rich region without natural barriers—mountains and rivers—to keep out potential enemies. Many times in its history, a dynasty crumbled before the onslaught of a foreign invader. Dynasties lasted normally only a few hundred years. Although cities did slow the attackers because they were fortified and thus defensible, the cities were more important in providing the setting for the development of sophisticated societies with long-lasting cultural legacies.

## EGYPT

Egypt had but a single river, unlike Mesopotamia, but it was equally dependent on its flow. The NILE floods annually, restoring the fertility of the soil on its banks, the basis for Egyptian agriculture in a desert environment. Agricultural settlements appeared along the Nile around 4000 B.C.E. The towns flourished because they were protected from invaders by the RED and MEDITERRANEAN seas and the deserts.

Egypt had only a few hundred thousand people in the Predynastic period, 5000–3000 B.C.E. By the Old Kingdom, c. 2575–2134 B.C.E., the population was 2 million, which grew to 7 million at the time of annexa-

tion by the Roman Empire. In 3100 B.C.E., Menes (Narmer) unified Egypt, establishing his capital at the new city of Memphis. From there he ruled a centralized state. He was pharaoh, or king of Egypt. The pharaohs built pyramids as symbols of their power and authority, in life and after. The pharaoh's greatest power came during the Old Kingdom, and the greatest pyramids were built during this era. At Giza is the largest of the pyramids, that of Khufu (Cheops).

The Egyptians were also polytheistic. Their principal god was Amon-Re, and they had a strong cult associated with Osiris. The cult believed in immortality, so logically they wanted their bodies to last forever, thus they developed mummification. The society was hierarchical, with the pharaoh as supreme head of society. There was also nobility, but the bureaucracy and military were more important. Other classes included priests, commoners, and slaves. Egyptians wrote in hieroglyphics on papyrus. They had skilled architects and engineers, doctors and mathematicians, and education was a path to being a scribe, a highly regarded job. Their calendar rested on observation of the movements of the stars and sun.

The Egyptian economy was predominantly agricultural, depending on the Nile, which also provided fish and birds. Crops included emmer (wheat) and barley for bread and beer, as well as vegetables and fruits. Post-harvest fields provided forage for cattle, sheep, and other livestock, which provided meat and dairy products.

Egyptian tools were simple—hoes, sickles, and the like, with plows drawn by cattle or oxen. Associated industries were wine and beer making, textiles, leather, pottery, baking, and woodworking. The exchange of goods and services was by barter because there was no monetary system.

Taxation was heavy. Egypt also mined and worked metal—gold and copper. Their bronze age began around 1500 B.C.E., and iron smelting began around the 6th century B.C.E. Stoneworkers quarried and worked limestone, calcite, granite, and diorite using bronze tools. They also mined minerals and semiprecious stones. Because wood was scarce, Egypt traded emmer, gold, and other items for it. They traded with NUBIA and southwestern Asians in SYRIA, Mesopotamia, and Canaan.

Alexander the Great conquered Egypt in 330 B.C.E., but his empire crumbled quickly after his death, with the Greek Egyptian Ptolemaic dynasty lasting until late first century B.C.E., when Cleopatra asked Rome into Egypt.

## INDUS RIVER VALLEY

The Indus River flows from a source in the HINDU KUSH and HIMALAYAS. It is unpredictable, like the Nile, and like the Nile, it deposits rich silt that keeps soil fertility high, allowing agriculture to thrive. The first crops cultivated in the Indus Valley were barley and wheat. This civilization also domesticated the chicken. Although Paleolithic communities had existed 200,000 years ago, and Neolithic communities from 8000 to 5000 B.C.E., complex society arose between 3000 and 2500 B.C.E.

The Indus Valley civilization prospered on the river plains and vicinity in what is western INDIA and PAKISTAN. About 2600 B.C.E., the early cities began to interact, creating a common urban culture that lasted about 700 years. The inhabitants were known as the Harappan or Indus culture, and it thrived contemporaneously with those of Mesopotamia and Egypt. Each of the societies had its unique art, technology, and social arrangements because each developed from a different Neolithic community that existed in the area until around 6500 B.C.E. The civilization extended from the mountains of AFGHANISTAN and BALUCHISTAN to Gujarat, Makran, and Sindh on the coast. At its peak this civilization traded with the other cultures on the Arabian Gulf, peninsular India, and West and Central Asia.

Two cities, Harappa and Mohenjo-daro, dominated. Each was fortified and supplied its citizens from a large granary. Having political and economic control, each was a seat of authority, a distribution site for the outlying region. The two cities may have served as co-capitals of the civilization. They did provide extensive development of the human aspect of the city—broad streets, marketplaces, temples, and diverse other public buildings.

The civilization developed standardized weights and measures as well as standard brick sizes and styles of architecture. It had specialized labor in pottery tools and decorative objects. It also engaged in trade with Mesopotamia from 2300–1750 B.C.E. India traded copper, ivory, and pearls for Sumerian wool. Other trade was in metals—gold, silver, copper, lead.

In Harappa, social status was shown by style of living, with clear differences between rich and poor. The religion was strongly based on fertility. The society began declining around 2000 B.C.E. because of deforestation, erosion of topsoil, and a general ecological decline that reduced the agricultural surplus, bringing on a problem of subsistence within the society. Also plaguing the civilization were a series of floods and earthquakes. The abandonment of the cities began

around 1700 B.C.E., and the civilization collapsed within 200 years, by 1500 B.C.E.

## CHINA

Chinese history records a cultural change under the leadership of three legendary persons around 2800–2600 B.C.E. Fu His gave China hunting, fishing, trapping, and most importantly, writing. They got agriculture and trade from Shen Nung. And government and Taoism came from the Yellow Emperor (circa 2700 B.C.E.). After that, the Chinese enjoyed enlightened rule by the three Sage Kings: Yao (around 2350 B.C.E.), Shun (around 2250 B.C.E.), and Yu (rule began in 2205 B.C.E.). After this, history being cyclic, from perfect wisdom and virtue the course of human events decayed.

China's early agricultural civilization arose under the Xia dynasty near the southern bend of the Huang (Yellow) River, which has its source in Tibet. Chinese agriculture began near the southern bend of the Yellow River approximately 4000 B.C.E. Initially the agriculturalists grew millet, but later they began growing rice near the Huai River to the south.

Neolithic societies arose after 5000 B.C.E. This was a stone-tool culture, tribal with some domestic animals but relying on hunting also. Some made fine pottery and bone tools. Presumably they engaged in intertribal wars and worshiped ancestors in some fashion. Neolithic China was a time of female rule, but the creation of complex large city-states resulted in a switch to a patriarchal society.

The Huang River is yellow because it contains suspended fine loess. It is “China's Sorrow.” Like the other nutrient-rich rivers, it floods periodically, bringing devastation. As people concentrated together, the need arose for authority to preserve order, settle disputes, and create public works. The Xia dynasty was the first effort to do this. Established in 2200 B.C.E. by Yu, it set the precedent for rule by a hereditary king. It also established flood control and political institutions. The central authority controlled the village leaders. It also emphasized metallurgy and the founding of additional cities as the population spread.

Between 1766 and 1122 B.C.E., the Shang dynasty controlled the area. It originated south and east of Xia. Its agricultural surpluses allowed it to maintain a large army. It moved its capital six times, but it left an extensive written record as well as material remains, including weapons and chariots in its lavish tombs. Next came the Zhou dynasty, which arose in the west, where the Shang lacked control. Because the final Shang was



a criminal, the Zhou unseated him in 1122 B.C.E. The Zhou introduced the idea of the mandate of heaven, the Right to Rule. They tied earthly events to Heavenly affairs. Divine mandate validated the Zhou claim to the throne because only virtuous rulers received the mandate. The Zhou king was titled “Son of Heaven.”

The early dynasties ruled through family and kinship groups. Worship of ancestors was integral. The belief was that the ancestors remained present and able to influence worldly affairs. The dead were buried with material goods, and the head of the family presided over the rites. Socially, the culture was stratified, with the royal family and nobility on top. Hereditary aristocrats had large holdings of land. Artisans and craftsmen were a small percentage of society, and some worked only for the ruling class. Merchants and traders went south and west, seeking jade from central Asia or military technology from Mesopotamia. The peasant class served in the military or worked the land or provided general labor for the ruling class. In return they received land to work. They lived underground. Women made wine, wove, and cultivated silkworms. Slaves performed the hardest labor; they were generally prisoners of war. Chinese culture was secular. There was no organized religion. Fortune-tellers used oracle bones to predict the future. Early Chinese writing was in pictographs. It developed to ideographs to handle complexity and abstraction. It had over 2,000 characters but no alphabet or phonetic element.

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ature, precipitation, cloud cover, air masses, atmospheric pressure, winds, and cloud coverage. Of these, temperature and precipitation are the most important factors in establishing climate type. A place may have rain on one day, clear conditions for a week, and then have cloudy skies the next day followed by a hailstorm. The conditions described here would certainly be familiar to a resident of the Midwest in the United States. Daily weather variability in any given place may be quite dramatic. Or the weather may be predictably uniform from day to day. The equatorial regions exhibit this kind of weather: warm temperatures, afternoon showers, slightly cooler nights, and then the repeat of the preceding day’s weather.

Whether the daily weather occurrences at a place are extremely variable or predictably uniform, it is the long-term averages of the weather factors that will be used to determine the climate of a place. Scientists in early GREECE devised a very simple and straightforward climatic system for the Earth, as they knew it. The system was composed of three zones or *klimata*. The zone occupied by the Greeks and other culture groups living near the MEDITERRANEAN SEA was called the Temperate Zone. This zone had temperature and precipitation values that made it ideal for human occupation.

To the south of the temperate zone was the Torrid Zone, an area simply too hot and debilitating for humans to survive. At the time of the development of this climatic system, no one from the temperate zone had traveled very far to the south and certainly not to the equatorial area. Consequently, a great deal of speculation centered on the region and what manner of protection any inhabitants would have to ward off the blistering rays of the sun. There was conjecture that a resident in this region would have feet large enough to extend over his head umbrella fashion to block the sun’s rays.

To the north of the Temperate Zone was the Frigid Zone, the unexplored area too cold for humans to survive. As simplistic as this three-zone system may sound today, it was nevertheless based on sound logic: Places to the south of the Greek homeland are warmer and places to the north are colder. These are true observations. However, today we can add immeasurably to the descriptions of our climatic systems and refine them to take into account even subtle changes from place to place.

## CLIMATE SYSTEMS

The climatic system most used in geography and climatology is the structure devised by Vladimir Köppen, a

## climate

THE TERM *climate* refers to the long-term averages of insolation (solar radiation absorbed by Earth), temper-

German climatologist and botanist. Köppen worked with his student Rudolph Geiger on the development of a climate map of the world first introduced in 1928. Although the formal name of the system incorporates Geiger's name (Köppen-Geiger), we know it today simply as the Köppen climatic system. Köppen's system uses capital letters to designate latitudinal bands from the equator north and south to the poles. A second, and in some cases a third, letter is added to distinguish differences within a main category. The primary capital letter designators are as follows:

- A Tropical climates
- B Semideserts and dryland climates
- C Humid mid-latitude climates
- D Humid continental climates
- E Polar climates
- H Highlands

The "A" climates are found along the equator and are further designated as "Af," or tropical rainforest, and "Aw," or savanna (tropical grasslands). The "B" climates lie north and south of the "A" climates. The "B" climates are further designated as "BS," or steppe (dryland grasses) and "BW," or deserts. The mid-latitude climate designated with "C" has three subclimates. This is a tipoff that there is greater weather (and climate) variability in the mid-latitudes than in any other region in the world. The "C" climate is further designated as "Cs," or Mediterranean climate, "Cfa" or humid subtropical, and "Cfb," or marine west coast.

It is interesting to note references to actual regions in the designations of some subclimates. For instance, Mediterranean climate regions are found on the West Coast of the United States, the coast of Chile, east of the Mediterranean Sea to Central Asia, and along the southern coast of Australia. These places are so designated because the climate found at their locations is identical to the climate of the Mediterranean region.

The "D" climates are next. They are designated as "Dfa," or humid continental with a hot summer, and "Dfb," or humid continental with a very cold winter. The "E" climates are found in the polar regions. "ET" refers to both the subarctic and tundra climates. "EF" identifies the ice caps on both the ARCTIC OCEAN and the extensive sheet ice that covers the land area of ANTARCTICA.

One major climatic region remains: the "H," or highlands climate. This climatic region is sometimes referred to in the geographical literature as the undiffer-

entiated highlands climate because the mountainous areas in which it is found have such steep gradients that several climate types may exist over relatively short distances.

## CLIMATE PATTERNS

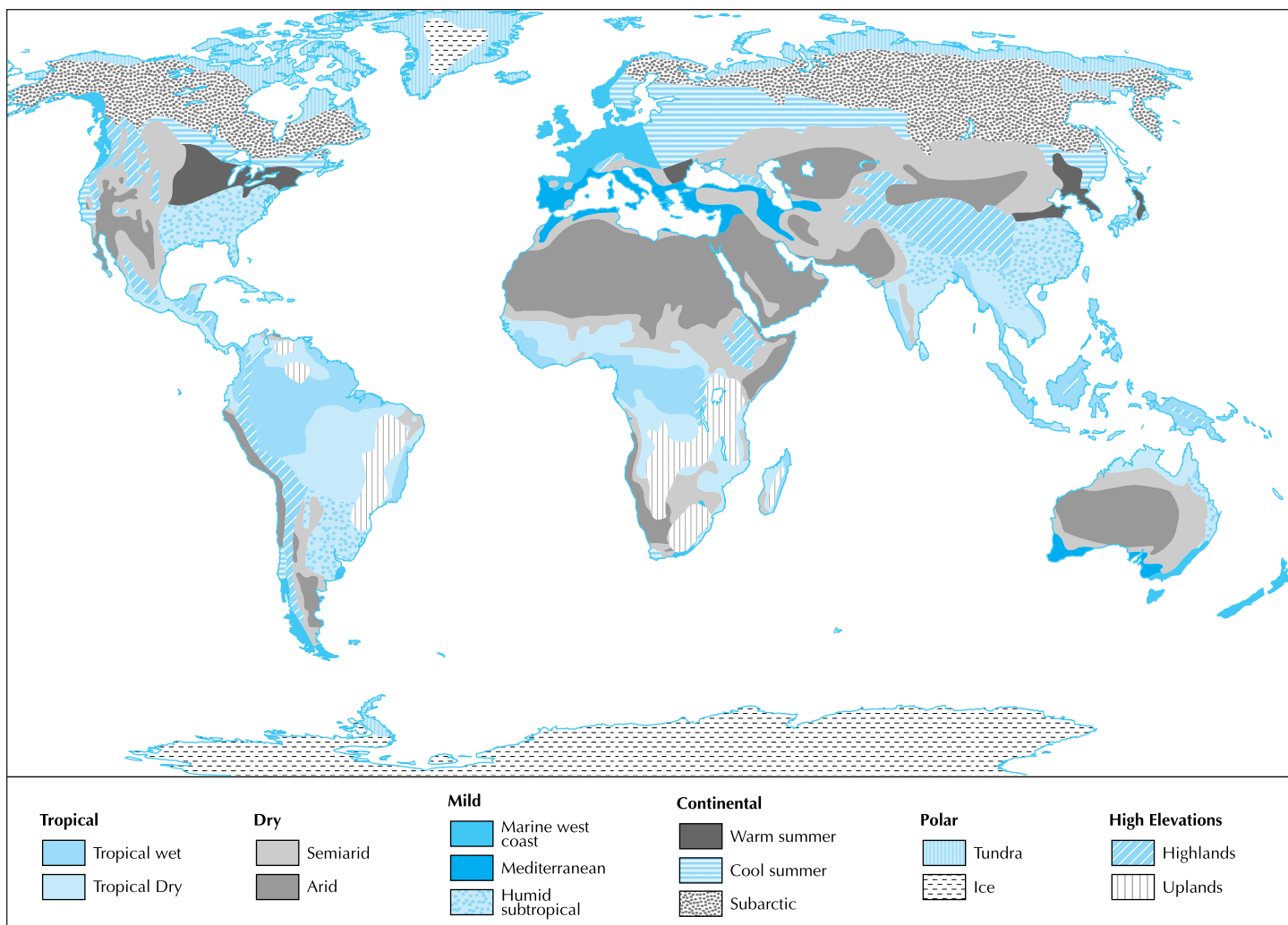
The patterns of climate on the Earth's surface are displaced by latitude north and south from the equator to the poles. Tropical rainforests straddle the equator in South America and Africa and extend to the coastal areas of MADAGASCAR, INDIA, Southeast Asia, and AUSTRALIA. This is a warm and wet climate throughout the year. A climograph of the region would exhibit fairly even temperatures throughout the year and significant rainfall in every month. The equatorial belt is the destination for the converging trade wind coming from both the Northern and Southern Hemispheres. These winds reach the equator and are lifted to high elevations, where condensation occurs and rainfall is produced in abundance.

The savanna regions lie astride the tropical rainforests. They are warm and moist, but their rainfall is seasonal. Consequently, the moisture received in the savannas will support grasslands and some trees but not the density found in the tropical rainforests.

The "B" climates are dry. Their dryness may be due to their leeward locations on mountainous terrain or a latitudinal location far from moisture-bearing winds. The "B" climate produces either steppe (dryland grasses) vegetation or true desert. Bands of steppe and desert are found in North Africa and the west coast and interior of southern Africa and within the Rocky Mountain and Basin and Range Provinces in the United States and MEXICO. The "B" climate is also found in extensive areas of Central Asia, northern China, and eastern SIBERIA. Nearly all of Australia is in the "B" climatic zones, the interior of this continent being desert.

The "C" climates are found in large areas in the Northern Hemisphere and to a lesser extent south of the equator. This fact is readily apparent with one glance at a globe. South of the equator, the land areas begin to dissipate rapidly. There is room for a bit of each of the Mediterranean, humid subtropical, and marine west coast climates in southern South America and southern coastal Australia. The very southern tip of South Africa has a mere touch of Mediterranean climate and a bit of the marine west coast.

In the Northern Hemisphere, large expanses of humid subtropical are found in a band from northern India to southern China and again in a large section of



*The display of climate regions on maps helps geographers understand the location of other environmental features that climate influences. Such climate-related features include water, vegetation, soils, landforms, and wildlife.*

the southeastern United States. The Mediterranean climatic zones, already discussed, are found on the West Coast of the United States and along the Mediterranean Sea and east to Central Asia. Marine west coast climate is found on the west coast of the U.S and extensively within the European LITTORAL and the eastern and southern expanses of the Scandinavian Peninsula.

The “D” climates do not occur in the Southern Hemisphere. In order for a “continental” climate to develop, there must be a large land area within the mid-latitudes. This is simply not the case in the Southern Hemisphere. So, the “D” climate is unique in that it exists in only the Northern Hemisphere where it is found in extensive areas of North America and Asia. The “Dfb” continental climate has warm summers and very cold winters. As such, the range in annual temperatures

is greater than any other climate. It is not uncommon for the temperatures in northern MINNESOTA to reach 90 degrees F (32.2 degrees C) in summer and 35 degrees F below zero (-37 degrees C) in the winter. The interior of eastern Siberia has even colder winters. Verkoyansk, a city in eastern Siberia, is called the cold pole of the Northern Hemisphere with record winter temperatures reaching 120 degrees F below zero (-84 degrees C).

The “E” climates are limited to the polar regions. In the Northern Hemisphere, large expanses of subarctic and tundra climates may be seen. *Tundra* is a word that designates a climate in which trees cannot grow. The boundary, then, between the subarctic and the tundra to the north is the tree line. Beyond the tundra to the north is the ARCTIC OCEAN, ice-covered most of the

year and carrying the climatic designation of “ET” or ice cap. In the far polar reaches of the Southern Hemisphere, only a sliver of tundra climate is seen on the Antarctic Peninsula as it juts into the ATLANTIC OCEAN south of Tierra del Forego. The only remaining climatic zone in the Southern Hemisphere is the vast ice cap covering ANTARCTICA, a sizeable “ET.”

### EFFECTS ON GEOGRAPHY

The climates of the world influence human occupants in innumerable ways. Combinations of temperature and precipitation will impact agricultural systems and dictate the types of crops that can be efficiently grown. People living in the tundra will dress quite differently than the resident on the shores of the BLACK SEA. And there will be little use for snowplows in Miami, FLORIDA; but there had better be a number of them on hand when winter reaches Buffalo, NEW YORK.

However, the commenter on climate must resist the temptation to say that the climate determines the kinds of activities that the human occupants may engage in. To do so would be to invoke the short-lived geographical theory of environmental determinism. This theory held sway in American geography during the first two decades of the 20th century. Simply stated, environmental determinism held that the environment, especially the climate, of a region determined the activities of the human occupants. It left no room for advances in technology or the ingenuity of the human occupants to overcome environmental limitations. This theory was eventually put to rest in favor of a more flexible view of humans and their environment and the realization that human-environment interaction is a two-way street.

One of the regions in which agricultural origins have been traced is the highland area north and east of the valleys of the Tigris and Euphrates rivers. This highland area contains a great number of individual microclimates in its valleys and slopes. Variegated regions such as these allow for the growth of multitudes of plants within a limited area. Strains of wheat and other grains grew in these physical recesses and were eventually discovered by the wanderers and gatherers populating the region. When it was realized that seeds from the plants in the ground would produce a new plant, agriculture was originated.

Climate is explained best as the combination of primarily temperature and precipitation over a long period of time. There are also examples of how the shape of climate regions can impact agricultural activity. The large and productive agricultural region in North

America has a unique areal combination of temperature and precipitation. Temperature decreases from south to north in the vast interior basin of the United States and southern CANADA. Precipitation, on the other hand, increases in an east to west direction from the ROCKY MOUNTAINS to the eastern seaboard.

The result of these patterns is the creation of an almost infinite set of microclimates with their own unique temperature and precipitation regime, an ideal setting for the growing of a wide variety of crops. The Fertile Triangle in the old Soviet Union is quite different. Although the region is larger than the one in North America, agricultural productivity is much lower. A large part of the explanation lies in the relationship between the temperature and precipitation zones. As in North America, temperature decreases from south to north. But unlike the North American pattern, precipitation also changes from north to south with the higher precipitation occurring in the south. The result is an agricultural system that is limited to a narrow band where the temperature and precipitation combination is ideal for the crops being grown.

There is another factor at work in this relationship. As we know, temperature and precipitation patterns in the mid-latitudes can be quite variable. There may be years of drought, times when the precipitation comes too early or too late, or there is too much rain or not enough. If this happens within the relatively narrow band of agricultural land in the old Soviet Union, significant losses can occur.

On the other hand, the primary North American agricultural region is displaced over a wider latitudinal band. The likelihood that the entirety of this agricultural region would be adversely affected by adverse temperature and precipitation conditions is virtually nonexistent. There may be climatic problems in part of the region but not in its entirety. The Central Valley in CALIFORNIA is an exceptionally productive agricultural region. This is explained in large part by its north-south alignment and the variety of temperature and precipitation combinations that are available. The Central Valley is the main reason why California is the leading state in value and variety of agricultural products produced.

Climates can change over time. There is geological evidence of these kinds of changes. It is true as well that human activity can bring about climatic change. A case in point is the demise of the tropical rainforest. The moisture that comes from the vast forests through the process of evapotranspiration rises aloft and is transferred north and south of the equator to the mid-



latitude regions. With the loss of moisture from the rainforest, there is the possibility of climatic change in the region receiving the moisture. Finally, continued melting of the pack ice on the Arctic Ocean and the great ice sheets covering Antarctica have already increased the mean temperature of the Earth a small amount. In time, considerable changes in climate could occur, not to mention the possible flooding of populated places worldwide as ocean levels rise.

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## climate classification

CLIMATE IS an average or aggregate of daily weather conditions over a period of years. Latitude, distance from oceans, atmospheric and oceanic circulation pattern, elevation, and local geographical features control the climate of a place. The controls of climate result in a plethora of interrelated elements of climate, ranging from temperature, pressure, wind, humidity, clouds, precipitation, ocean currents, and so on.

Climate classifications are orderly arrangements of data dealing with climatic controls and elements. The purpose of such schemes is to identify climate types and subtypes. Maps and graphs display the climates (for example, wet tropical climates). The classifications typically identify climate regions and subregions that cover broad areas that are subcontinental in size.

The display of climate regions on maps helps us understand the location of other environmental features that climate influences. Such climate-related features include water, vegetation, soils, landforms, and wildlife. They also help us understand the influence of climate on distributions of things important to humans, such as agriculture, tourism, living comfort, and

climate-related natural hazards. According to John E. Oliver (1973), there are two approaches to classifying climates—empirical and genetic.

The empirical approach to climate classification uses observed effects of climate (climatic elements). Its primary purpose is to identify the spatial distributions of different climates. The classifications typically use statistics for temperature and precipitation, as weather stations invariably have data on these elements. However, all climatic elements are inherently significant for one purpose or another.

The Köppen classification system is the most famous empirical classification. Originally devised by Vladimir Köppen and published in 1918, the scheme sought to identify vegetation patterns.

Köppen developed statistical parameters using temperature and precipitation data in order to classify climate. He also used vegetation, a natural climatic indicator, as a climate proxy, if temperature and precipitation data were unavailable. A system of letters identifies each climate type; for example, Cfa indicates a humid subtropical climate with a mild winter (C), year-round precipitation (f), and hot summer (a). The Köppen system has undergone various modifications since its inception, but it is arguably the most widely used system for mapping climatic regions on a continental and global scale.

C.W. Thornthwaite devised a rival classification system in 1948. The system focuses on moisture availability and climates. The Thornthwaite scheme is not as highly regarded as the Köppen scheme for its mapping of climates, but it is widely accepted for its practical application to monthly water budget analyses.

Whereas the empirical approach concerns where climates are, the genetic approach seeks to explain why climates are where they are. Thus, genetic classifications use causes rather than effects to delineate climate regions. They focus on dynamic controls of climates (processes that govern exchanges of energy and mass between Earth's surface and the atmosphere). The genetic approach is more theoretical than concrete, as cause and effect is difficult to prove in the complex Earth-atmosphere system.

Geographers developed the genetic approach by focusing on air masses as the main controls of climates. Based in part on the work of Arthur N. Strahler in 1951, John J. Hidore formulated one of the best-known dynamic climate models in 1969. Using seasonal patterns of radiant energy and precipitation, Hidore refined Strahler's earlier grouping of air mass climates into tropical, temperature, and polar types.

The model includes nine climates, three climates in each of the three major groupings. There are also four types of air masses (maritime tropical, continental tropical, maritime polar, and continental polar). The frequency (measured in number of months in the year) and seasonality of air masses in a region determines the region's climate. A world climate map by Strahler and Strahler (2005) has the same tripartite major grouping, but it includes fourteen climates with six possible subtypes.

Climate classification arose from a need to empirically define climates and their boundaries and to explain climate distributions. By the mid-twentieth century, geographers had developed several successful classifications. The schemes used relatively simple statistics, maps, and graphs. In contrast to a growing sophistication in climate science as a whole, climate classification today more often than not relies on these early schemes or revisions of them.

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## coastal zone

THE COASTAL ZONE is where nature breathes its essence into poets and painters. Ancient Greeks believed it was where Neptune's energy encounters land. People living in the UNITED STATES call this transition between land and sea the shore, coast, or beach. Robert Gabler et al., define the coastal zone as "the dynamic region on land as well as areas currently submerged under water, through which the shoreline boundary fluctuates."

The seaward margin of the coastal zone is where the motion of approaching waves touches the seafloor. The landward boundary is the highest elevation on the land affected by storm waves. The width varies between a few meters and hundreds of meters. The surface varies from sandy to rocky. The rhythmic rise and

fall of the tide causes the shoreline to fluctuate within the zone.

The coastal zone's appearance depends, in part, on its sediment budget, or the balance between sediment inputs and outputs. The budget involves mostly sand. Waves determine the balance. As waves crash (break) on shore, the turbulent surf and swash (the sheet of water that rushes up the beach) supplies inputs of sand. The undertow, which is water coaxed back into the ocean by gravity, determines sand outputs. A longshore current, which travels parallel to the shoreline and within the zone, transports sand to and from the breaking waves. Longshore currents distribute sediment that rivers discharge into the ocean. Tidal currents help distribute the sediment to sedate areas where waves are weaker and longshore currents do not exist, such as in coves, bays, and estuaries.

Shorelines whose sand inputs exceed outputs have surplus budgets and are of the depositional type. Depositional shorelines in general have large beaches. A beach has two parts: 1) a beach face, which dips gently below the water's edge; and 2) a berm, which is a flat area just behind the beach face. Broad beaches typically have sand dunes on their landward edges. Wind blowing from the sea crosses over the beach, picks up dry sand particles, and transports them to the dunes. Under the right conditions (no storms, dry weather, strong onshore winds, and ample supply of dry sand), dunes grow beyond the landward limit of the coastal zone.

The spit, barrier island, and DELTA are also depositional features of coastal zones. A spit is an offshore ridge of sand that stands above water and runs parallel to a shoreline, but at some point, the spit connects to the shore. A longshore current delivers sand to the spit, allowing it to grow parallel to the shore. The unattached end of the spit sometimes curves shoreward but leaves a narrow opening between itself and the shoreline. A barrier island also runs parallel to the shoreline. It is usually a product of spit segmentation brought about by storm waves.

The semi-enclosed water body (estuary) on the landward sides of spits and barrier islands escapes the brunt of the ocean's wave energy. Weak waves and tidal currents build up mudflats around the quiet estuary's edges. Salt marshes and mangrove swamps thrive on the mudflats. A delta forms at the mouth of a river when the river carries more sediment than longshore currents can redistribute to other parts of the shore.

Depositional shorelines are not without erosion problems. The U.S. southeastern Atlantic Coast and

Gulf Coast are examples. Severe storms cause sand deficits locally that take years, even decades, to replace. Moreover, the region's slow tectonic subsidence causes gradual erosion. A rise in sea level from human-induced global warming also plays an important role, as do the design and placement of human structures such as jetties, groins, and seawalls.

Shorelines whose sand inputs are less than sand outputs have negative budgets and are of the erosional type. The hardness of rock usually determines the shape of an eroding coastline. Pounding waves hack wall-like sea cliffs into the land. Areas that are more resistant to erosion become cliff-edged headlands (sections of land that jut into the sea). Waves focus their rage on the headlands. They carve into their faces sea caves, sea arches, and sea stacks (small rocky islands). Small bays separate the headlands. Waves are weaker there and leave behind narrow, curving strips of sandy beaches. Over time, the unrelenting waves cut into the land to create rocky submarine benches (flat areas). Many erosional shorelines occur where tectonic uplift is occurring. The U.S. West Coast is an example of such a shoreline.

The ever changing, high-energy beach is inhospitable to most life forms. Ubiquitous shorebirds scurry across the sloping beach face, probing for tiny worms, crustaceans (beach hoppers and sand crabs), and mollusks.

Life is more prolific elsewhere in the coastal zone. Rocky edges and bottoms are havens for lobsters, oysters, corals, periwinkles, mussels, barnacles, starfish, and sea anemones. The protected estuary and its fringing mudflats are habitats for an even longer list of species. The mudflats harbor salt-tolerant grasses, fiddler crabs, and tube worms. The nutrient-rich estuary is a refuge for juvenile and adult fishes, crabs, clams, and oysters. Large numbers of birds, both year-round residents and migratory, frequent the entire coastal zone.

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## Cocos Islands

THE COCOS (or Keeling) Islands are a dependency of AUSTRALIA located in the INDIAN OCEAN, about 1,675 mi (2,700 km) northwest of Perth, and 620 mi (1,000 km) southwest of JAVA, INDONESIA. Unlike the volcanic peak of their closest neighbor, CHRISTMAS ISLAND, 560 mi (900 km) to the northeast, the Cocos Islands consist of two flat coral atolls, roughly 15.5 mi (25 km) apart. The islands were long owned privately but are today a holiday resort for Australians attracted to its beaches and abundant wildlife.

The two atolls are the tops of the Cocos Rise, a volcanic ridge rising 5,000 ft (1,500 m) from the ocean floor. Reefs started forming here only about 1,800 years ago, and today form a lagoon around the main atoll (South Keeling), covering 43 square mi (110 square km), with over 32 mi (52 km) of reef enclosing 26 small islets. The largest of these are West Island (Pulo Panjang), South Island (Pulo Atlas), Home Island, Direction Island, and Horsburgh Island (Pulo Luar). The smaller atoll is composed of only one island, North Keeling, which is only 1.2 mi (2 km) long and about 1,320 ft (400 m) wide. This atoll is entirely covered by the Pulu Keeling National Park, an important breeding ground for seabirds like the red-footed booby and for green turtles. It is the only island in the Indian Ocean free from natural predators (snakes, weasels, dogs, etc.), and is thus protected as a unique natural habitat. The park, created by the Australian government in 1995, also includes the reef up to .9 mi (1.5 km) around the atoll, known for its 99 species of coral and endless mollusks, crustaceans, and tropical fish.

The islands' two names have both been used since the 17th century. The name *Cocos* appears on mariners' charts at the same time as the sighting in 1609 by Captain William Keeling. The first settlement wasn't built until 1826, when officials of the East India Company brought Malays from SUMATRA and Java to grow cereals, vegetables, and coconuts (for oil and copra) to supply the company's ships. The chief administrator was John Clunies-Ross, and although Great Britain formally annexed the islands in 1857, Queen Victoria granted full rights over the islands to the family of Clunies-Ross in 1886. Sovereignty was transferred to Australia in 1955, but the "kingdom" of the Clunies-Ross family was not finally bought out by the Australian government until 1978 (for 6.25 million Australian dollars) and transferred to the local Cocos Island Council (made up mostly of Malays).

The Cocos islanders then voted to become part of Australia in 1984, giving them citizenship and access to social services. The Cocos Malays are a unique group, cut off from their culture for eight generations, yet remaining strongly attached to their Islamic faith and traditions. Most of them live on Home Island, whereas most Australian government workers reside on West Island. There are no industries, except a small coconut crop, so the island suffers from high unemployment. Tourism is small, though there are plans to open a large resort.

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## Colombia

**Map Page** 1139 **Area** 439,735 square mi (1,138,910 square km) **Population** 42,310,774 **Capital** Bogotá **Highest Point** 18,947 ft (5,775 m) **Lowest Point** 0 m **GDP per capita** \$6,300 **Primary Natural Resources** petroleum, natural gas, coal, iron ore.



**COLOMBIA IS** A country located in northwestern South America. Named for Christopher Columbus, it is the only South American country to have coastline on both the CARIBBEAN SEA and the PACIFIC OCEAN. The fifth-largest country in South America, Colombia is a nation of great geographic contrasts. From the 16th through 19th centuries, Colombia was a Spanish colony. In the early 1800s, the country gained its independence as part of Gran Colombia, consisting of modern-day Colombia, VENEZUELA, ECUADOR, and PANAMA. By 1830, Venezuela and Ecuador had separated from Colombia. In 1903, Panama also broke away from Colombia.

The Colombian ANDES consists of three ranges, or cordilleras. The Cordillera Occidental, Cordillera Central, and Cordillera Oriental branch off from each other just north of Colombia's border with Ecuador

and run parallel to the north and northwest. While the Andes in Colombia are not as high as in some other South American countries, they have still traditionally posed a barrier to effective communication in the country. At the same time, they have provided Colombia with natural resources. The Cordillera Oriental is a major source of emeralds, allowing Colombia to become the world's leading producer of the precious stone. Colombia is the world's second leading producer of coffee; most is grown in the Andean highlands at altitudes of approximately 3,000 ft (914 m) to 6,000 ft (1,828 m).

The Andean highlands are the most densely populated region of Colombia. During the 19th and 20th centuries, between 60 and 70 percent of the country's population lived in the 15 percent of the territory located above 3,330 ft (1,006 m). Historically, the Andes have been the center of political and economic power in the country. Before the arrival of Europeans, Native American settlements concentrated in the Andes. Most notable were the Chibchas, a sedentary group who lived near modern-day Bogotá. This region also attracted early Spanish colonists in the 1500s because of its mineral resources such as gold, a more pleasant climate than the tropical lowlands, and the potential labor force of the Native Americans.

In 1538, the Spanish founded the city of Bogotá in the Cundinamarca basin because of the fertile soil and temperate climate. As the capital of Colombia, Bogotá became and continues to be the political, cultural, and artistic center of Colombia. By the early 21st century, the city had nearly 7 million inhabitants. Other major cities in the highlands include Medellín and Cali. Located in the Antioquia region, Medellín prospered in the 19th century from the coffee industry. Residents invested much of the coffee profits in factories, making the city into Colombia's industrial, banking, and commercial center. Cali can be found in the Cauca Valley, a rich agricultural area. At the end of the 20th century, both Medellín and Cali served as centers for the illegal drug trade.

Two major river valleys play important roles in the Colombian highlands. The Cauca Valley is a narrow rift valley through which the Cauca River flows. The Magdalena River Valley is navigable for 600 mi (965 km) from the Caribbean coast. Until well into the 20th century, the Magdalena River was highland Colombia's main link with the outside world, as people and goods traveled up and down the river.

However, there were limitations to transportation along the river, as it possessed a difficult entry to its



mouth and numerous rapids. Travelers sometimes needed as long as two months to travel along the tropical and mosquito-infested river. The Magdalena Valley has also been an important source of petroleum for Colombia.

Colombia possesses tropical lowlands along both the Caribbean and Pacific coasts. The Pacific coast is more sparsely populated. The natural conditions along the Pacific coast, such as the heat, heavy rainfall, and dense forests, have traditionally inhibited large settlements. The Pacific coast has a large Afro-Colombian population. Many of the region's inhabitants practice subsistence agriculture. Buenaventura is the main Pacific Port and is connected by rail to Cali.

Three main port cities dominate the Caribbean coast of Colombia. Founded in 1533, Cartagena was the principal Spanish colonial port in northern South America. By the 19th century, Baranquilla and Santa Marta were the country's main ports. The region around Santa Marta also became an important banana producing area. All three Caribbean ports have been important in connecting the outside world to the main population centers of Colombia in the Andes. Historically, communication took place via the Magdalena River.

The southeastern plains and jungles of Colombia comprise over half of the country's territory. However, the region contains just over 1 percent of the population. Located beyond the eastern Andes mountains, the *oriente* covers some 250,000 square mi (647,947 square km), representing about 60 percent of the country's total area. The region is roughly divided into two parts by the Guaviare River. The northern section of the region is known as the *llanos*, which is an area of grasslands used mainly for ranching. The *llanos* in turn are divided into two parts. The *llanos arriba*, or high plains, are closer to the Andes, receive more rainfall, and are used more for agriculture. The *llanos abajo*, or lower plains, receive much less rainfall and are used principally for grazing. The southern section of the *oriente* consists largely of tropical rainforest that reaches into the Amazon jungle. By the late 20th century, the southeastern section of the country had become more important thanks to the discovery of significant oil deposits.

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## colonialism

FROM THE ONSET of trade, the merchant traders established colonies in the foreign places where they did business. Those early merchant colonies were not colonialist in the strict sense. The merchants resided in foreign cities by the grace of the city officials. More commonly, colonialists dominated the indigenous peoples. The Greeks and Romans established military posts in the territory they conquered. The Greeks had most of the eastern Mediterranean islands, and the Romans had control of ISTANBUL, TURKEY, and North Africa to Gaul and Britain. The Roman garrisons included women for working in the fields and increasing the population to the point that the post could become a self-sustaining settlement. The English tried the same philosophy in IRELAND and VIRGINIA, with initial failures giving way to eventual success.

Another case of losing some and winning others came late in the first millennium. The Vikings colonized GREENLAND and Newfoundland, but the colonies failed for lack of support from home. The Norsemen, during their heyday when much of Europe was dark and isolated, enjoyed greater success in colonizing France, Sicily, Ireland and England, establishing a permanent presence as Normans.

Colonizing efforts were also part of the Crusades from the 11th to 13th centuries. And the Mongols of Central Asia established an empire in the 13th and 14th centuries that stretched from the URAL MOUNTAINS to RUSSIA. The Mongols were cavalry, as were the Ottomans who established an empire that included North Africa, the MIDDLE EAST, and the Balkans. The OTTOMAN EMPIRE lasted from the 13th into the 20th century. African and American indigenous peoples were also builders of empires—the Fulani and Zulu of Africa and the Inca and Aztec of the Americas.

## DEFINITION

Under colonialism, a state claims the right to rule territory and people outside its boundaries. The purposes for this rule may include a desire to control resources, markets, or labor. Colonies may also serve as an outlet

for home surpluses of population or goods. Colonialists commonly believe that they are superior in some respect to those colonized. Colonialism can be rationalized as fulfillment of an obligation to lift up the lesser peoples, by whatever means. And defenders of colonialism often cite the economic and political, perhaps even social, benefits that the colonized received from the colonizers.

Modernization and democracy are among the greatest benefits advocates of colonization often claimed. Sometimes colonies did flourish. Success stories included SINGAPORE and INDIA. Countering the benefits argument are dependency theorists such as Andre Gunder Frank, who emphasize that colonialism is a process whereby the colonizer takes resources that would otherwise have allowed the colony to develop on its own. Another criticism, represented by postcolonialist Franz Fanon, is that the mere fact of colonialism promotes psychological and moral and political damage to the colonized.

Historical examples of colonialism abound. Generally, the colonizer uses aggressive acts, commonly military in nature, to acquire territory occupied by others. Colonialism may be used interchangeably with imperialism, but there is also a distinction—colonialism assumes political control, while imperialism may include political or economic domination, either of which can be either informal or formal.

Colonial types include colonies of settlement, colonies of exploitation, and contested colonies. Empires routinely included more than one type. Colonies of settlement included NEW ZEALAND and Virginia, while NIGERIA and JAMAICA were colonies of exploitation. Contested colonies included KENYA, and the British Empire also included a sphere of influence in ARGENTINA and a preexisting empire in INDIA. FRANCE's empire included settlement colonies in ALGERIA and Quebec, exploitation colonies in South America and Africa and a preexisting empire in Indochina.

Colonies of settlement were the result of migration, expulsion of indigenous people, and the assimilation of foreign crops and animals as well as a foreign culture. The colonial settlement of British North America was of this type. So was the settlement of AUSTRALIA. In colonies of exploitation, the European presence was small. Generally, the Europeans were administrators or military officials or merchants. They used whatever means necessary, including force, to establish sufficient political control to achieve the benefits they sought, perhaps strategic location against other European powers or economic advantage.

Colonies of exploitation took advantage of the local economy, using local labor to generate export crops under a plantation system. This type of colony prevailed in Asia and Africa. In the Caribbean and parts of South America, exploitation of the indigenous peoples was so harsh that the labor force literally died away. In these cases, the colonialists resorted to importing plantation labor from other regions where they had some semblance of a colonial presence. The use of African slaves on European-run plantations in Jamaica and the BAHAMAS is an example. A similar approach is the use of convict labor in the French and English penal colonies.

Contested settlement colonies were the ones in which European settlement was pronounced but not sufficient to exclude locals. The Europeans set up their own governments and societies in the midst of the co-existing society. European whites dominated an indigenous population that actually flourished because it remained the basis for economic survival and growth. Eventually the indigenous populations ousted the colonials. This process occurred in Algeria and Rhodesia. The example of India also applies.

At its peak in 1939, European colonialism spanned 20.3 million square mi (52 million square km) with a population of 629 million. The five colonial powers—Great Britain, France, BELGIUM, the NETHERLANDS, and GERMANY (by 1939 noncolonial, but its possessions were mandates and protectorates of the others)—had a combined home population of 172 million people in a space of 1.4 million square km (541,000 square mi).

Economies of the settlements and exploitive colonies were different (in this context the contested settlement colonies were handled similarly to the exploitive colonies). Settlements initially produced raw materials such as wool, gold, agricultural products, ships' stores—their primary markets were the home countries.

As the colonies grew and matured, they came to resemble the European nations economically, with diversified agriculture and manufactures. These colonies acquired self-rule early, which allowed them to use protective tariffs to nurture infant industries. Protection allowed high wages and standards of living. In colonies of exploitation, the home country's influence and control lasted longer.

The colonies remained underdeveloped, often even after independence. Their economies had two sectors—export and subsistence. Exports included sugar, rubber, gold, tin, and other raw products. Capital investment in these colonies was in exports. Another sector was

that of the small native middle class and semiskilled or unskilled labor.

This was the traditional economy, with a low and lowering standard of living as colonial resources left the country via railroads and other infrastructure intended to expedite exports rather than intercolonial commerce and communication. This sector had to make up the social costs of the export sector, characterized by low wages and few benefits.

The squeeze intensified over time as subsistence economy populations grew and the export economy took increasing amounts of wealth for the home country. The postcolonial situation in these colonies was one of dependence on the former colonizer, continued investment in the export sector, and lagging economic development beyond the subsistence level.

### MERCANTILE ERA

A major period of European colonialism occurred from 1492 to 1776. During this time Europeans spread through the rest of the world. PORTUGAL, SPAIN, Holland, France, and England competed in Africa, the Americas, and Asia. Each sought to establish mercantile trade arrangements at the expense of the others. The style was exploitive as each subordinated the indigenous population and established a presence that included military, traders, and plantation managers.

For Spain, the goal was extraction and export of America's gold. The English sought to intercept the gold shipments through piracy. The Dutch specialized in banking and other commercial services. Gold was but the first raw material—where it was unavailable, colonialists exploited whatever resource they found—sugar, tobacco, furs. And they settled as necessary to control their possessions and the transfer of colonial material to Europe. With the INDUSTRIAL REVOLUTION, they also used the colonies as suppliers of raw material and as outlets for their finished goods.

Commonly during the first imperial era, the Europeans found themselves confronted by stronger forces. They had small numbers and only limited technological superiority. They sometimes failed, as in the early efforts in the Americas. Success came when they enlisted indigenous allies—in MEXICO, or Virginia, or CANADA. When the natives resisted in force—in Africa and Asia early on—the conquest was more tenuous. Effective use of the divide-and-conquer technique and a slight technological superiority allowed Spanish conquest in Mexico, and the introduction of European diseases helped the process considerably. Once in power, the Spanish began establishing the extractive export

economy. In Asia, conquest was a matter of Europeans sitting on the coasts as merchants, adapting to local custom, politics, and trading patterns, slowly moving inland as indigenous resistance weakened. Dependence never became dominance, though, because the Europeans lacked numerical or technological superiority.

When possible, the European governments encouraged migration. The French failed to achieve a large enough presence in North America and eventually lost an empire. The English established colonies that grew with natural increase and immigration, taking more land in a slow and methodical conquest of “empty” lands.

The increased European population created a larger export of raw materials, a greater demand for finished goods, and a larger fleet—all within a system that was purely European to European—no local elites to pander to. The only aliens were the slaves imported to make the agricultural economy flourish after Europeans balked at the harshness of the indenture system. The system was unshakable and highly profitable until the American Revolution.

Overall, though, the mercantile effort was a time of harsh rivalry that slowly drained the weaker competitors as they lost markets and gold and the ability to compete against the British system. Portugal, Spain, Holland—all faded as their exploitive empires weakened in the face of England's settlements. Even though France lasted through four colonial wars, it too failed from lack of adequate population to control its territories and feed wealth to the home country. England made political mistakes after the French wars, and the result of its attempt to extract more from the American colonies, now close to mature and certainly not inclined to be exploited, was the loss of the jewel of its empire—the UNITED STATES. Also, the sugar islands became less profitable as the sugar beet became an alternative to slave-harvested cane. Empires went out of fashion for more than a century.

During the hiatus there was sporadic colonial activity, with the British establishing outposts in the Cape Colony (1815), Hong Kong (1842), and New Zealand (1840), while the French entered Algiers and attempted an empire in Mexico. But the rivalry was weak during this period of free-trade imperialism abroad and protection at home.

With European markets closed, Britain especially sought overseas markets. And as the dominant economy in the world, Britain preferred free trade wherever possible. This imperialism was by trade agreement rather than by treaty of surrender (the tool of choice

when occupation was desired, as in the U.S. Native American wars).

### THE FINAL RACE FOR EMPIRE

In the mid-19th century, the race for colonies revived. Rather than entering a great unknown as had the first colonialists, the 19th-century venturers knew what they were looking for and had a good idea of what they would find. And the world map showed that there were only limited areas left to colonize for national prestige and geopolitical influence and maybe the chance to spread the Christian gospel. Markets were the target, not living space.

Triggering factors were the economic depression of 1873, which raised specters of mass unemployment, the Franco-Prussian War of 1870, which revived nationalism, and the reports from Africa of Dr. David Livingstone (1813–73) that encouraged the reformers, Christianizers, and humanitarians.

Russia entered Persia. Austria-Hungary took a bit of the Balkans. ITALY acquired a hold in North Africa. Germany moved toward Baghdad (present-day Iraq) and took a bit of southwest Africa. Britain expanded from the Cape in SOUTH AFRICA to Cairo, EGYPT, took the Suez Canal, and grew its settlements in Canada. Even the United States jumped into the race, taking former Spanish possessions after the war of 1898 and inserting its presence into Canada and Mexico.

This time, the technological advantage was all with the outsiders—railroad tracks and steam engines and the telegraph—as well as vastly more sophisticated weapons and medicines, such as quinine, which allowed Europeans in malarial regions they could not have entered in the first phase. As before, the initial approach was divide and conquer, establish plantations and subordinate the locals, and extract and exploit to fuel the industries at home and increase the national wealth and power.

In Africa, the Europeans failed to recognize that the region was not as primitive as they thought. Trade routes ranged across the SAHARA DESERT north and west. Eastern Africans traded from MOZAMBIQUE to SOMALIA. Inland empires such as Mwene Matapa and Great ZIMBABWE were in the trade network too. With trade came cultural and social interchange. The European intrusion of the first colonialism weakened the fringes of the network, but the 19th-century inroads destroyed the whole thing, to the core of the continent. The British entered Africa with a touch of guilt about their slave-trading history and more than a touch of desire for African products such as groundnuts and

palm oil. To get raw materials for oiling machines and making margarine and soap, the British co-opted local political leaders. Their main interests in the continent were at Suez and South Africa.

With the Suez Canal open, India became 6,000 mi or 9,656 km closer to Britain. When the British bought out the Khedive of Egypt's French canal stock, they had control of the route to India. In South Africa, the attraction was diamonds. After discovery of the Kimberley field in 1870, the British annexed it in 1871. In 1877, they took the Transvaal, leading to a Boer uprising and a British backing off—until the discovery of Transvaal gold. Cecil Rhodes (1853–1902) tried to overthrow the Boers in 1895, and the British fought a second Boer War from 1899 to 1902. Having won South Africa, the British granted home rule in 1906, forcing the colony to take care of financial and moral issues raised by the conquest.

But the discoveries of diamonds and gold mattered more than just to the Boers and British. Europeans wanted a share of the non-European world, no matter its value, just in case. If nothing else, it was a matter of national pride—and having a possession meant that a European rival could not get it. The competition was so fierce that the Europeans met at Berlin in 1884–85 to divide Africa. They agreed no nation would try to take another's territory. By 1914, only LIBERIA and ETHIOPIA were without European control. Elsewhere, peanut, rubber, cocoa, and palm oil plantations appeared, as did gold and diamond mines in South Africa and copper and tin mines in the Congo.

Europeans unseated difficult indigenes but allowed great leeway in matters such as keeping slaves, to those who guaranteed stable labor and good output for export to Europe. The result was a new exploitive economy, and an alteration of internal social and economic relations as the subsistence economy replaced the traditional pan-African one.

### THE END OF COLONIALISM

By the end of the 19th century, the Ottoman Empire was crumbling, but it had assets that the others wanted. Russia wanted access to the Mediterranean via the BLACK SEA. Egypt broke away and became a cotton exporter as well as home to the Suez Canal—and eventually a subset of the British Empire. Persia had oil; Britain and Russia wanted oil. Britain and Russia split Persia at the turn of the century.

Britain had been in India (or at least the British East India Company had been) since the mercantile era. As the indigenous Mughal Empire faded in the



early 18th century, the company took territory after territory. Britain forced enactment of a law requiring India to supply coffee, tea, indigo, cotton, and plantation crops at the expense of internal consumption crops. And Indians were prohibited by law from developing manufactures. The company built railways to the coast, making exports easier.

On the other hand, the British did give India a decent infrastructure—dams, roads, communications, educational system, sanitation—and Indians did show improvements in health and literacy. The lack of adequate agriculture for home consumption did increase the risk of famine and death, and British paternalism weakened Indian culture and exacerbated racial tensions and nationalism. The company lost its franchise in the 19th century, and Britain lost India in the 20th.

The pattern was the same in Southeast Asia, the pathway to the Chinese market as well as a natural area for plantations producing rubber, cocoa, coffee, and sugar. Colonialists progressed from trading post to negotiations with local rulers to control of the local economy to shifting from internal to external crops to increased investment that required a military presence to ensure stability. The Dutch took over INDONESIA's economy and government. Britain acquired MALAYSIA, Singapore, and Burma/MYANMAR.

Frequently, the British used the skills and networks of the overseas Chinese merchants instead of sending Englishmen. Aside from ensuring profitability, this tactic also diverted indigenous hostility away from the British and onto the Chinese. French Indochina was rich with rice plantations. In the area, Siam/THAILAND managed to dodge the colonialists. Colonialism brought schools, sanitation, better health, and outsiders to manage and sometimes to work in the mines and on the plantations. The cultural mix was unstable, changing from the traditional one. And the economic balance was in favor of Europe.

The carving up of China into spheres of influence was a classic case of exploitation without obligation: the open door. China didn't want what Europeans had to offer. But Europeans wanted Chinese tea and porcelain. When the Chinese tried to eradicate their opium trade, the British went to war to preserve the right of free trade in opium. That war (1839–42) ended in the first concessions and the opening of China to European and American exploitation. The end came at the turn of the century with spheres of influence under the open door.

Matthew C. Perry opened JAPAN in 1854 as the United States sought links to Asia for trade. The mo-

mentum halted during the American Civil War, but post-Reconstruction industrialization spurred demands for raw materials and markets and some stability for an unstable economy. Military and missionary impulses were strong too, as was the "white man's burden" to remake the world in the Euro-American image. And national ego was on the line. Imperialist successes came with the purchase of ALASKA, the annexation of the Midway Islands, and finally Samoa (a naval base on Pago Pago in 1878; formal partition in 1899) and HAWAII (annexed 1898), both on the trade routes—Samoa on the route to Australia, Hawaii to the broad Asian market. And the PHILIPPINES, insignificant for trade, but a stepping stone to the Asian markets, was also acquired. Other stepping stones to Asia included Guam, Wake, and Johnston Atoll. When China opened, the United States was ready.

There was also the matter of Latin America, another victim of free trade with European and American businesses backed by government pressure forcing their way into a peasant economy, working with local elites to make market economies. Eventually, German and American control came to indigenous industries. U.S. interest included the mid-1850s filibusters of William Walker, the repeated talk about annexing CUBA and the attempts to buy it. After Spain lost the war of 1898, the United States kept bases and controlled internal affairs, foreign policy, and the economy until 1934 under the Platt Amendment; Cuba was a de facto protectorate.

Eventually, prior to nationalization in Mexico, American interests controlled 70 percent of Mexico's oil and 80 percent of its railroads. In Canada, American companies were strong in the automobile industry as well as electrical and forest products. This was the precursor to the post-World War II economic colonialism.

Japan modeled itself on the colonialist model instead of letting itself become colonized. It became militarily strong and modern, industrialized, and adapted what worked from Western ideas, and discarded the rest. Nationalist and disciplined, Japan became a regional imperialist after it defeated Russia. The Japanese carved out their section of China and expanded the Greater East Asia Co-Prosperity Sphere until it clashed with U.S. aspirations in Asia.

## COLONIAL CONCLUSION

The colonial experience brought progress to the colonized, but it also brought greater prosperity to the colonizers. At the beginning of the first colonial era,

wealth was distributed more equitably than it was at the end of the second. The disparities continued to grow. Global empires covering 8.75 million square mi (22.6 million square km) did not last. After World War II, the colonial Europeans were discredited and debilitated by the costs of the war. Their empires crumbled as country after country in Africa and Asia won or received independence. Some emerged more easily than others; all faced major difficulties, being mostly economically backward with inadequate experience in determining their own futures. They may have been politically free, but they remained export-oriented economies with subsistence populations with marginal skills and education and no serious prospects of equal competition in a free trade world. The new buzzword was neocolonialism.

Neocolonialism is a product of the postwar economic arrangements made by the European winners at the Bretton Woods economic conference. Critics point to the World Bank and World Trade Organization, created at the conference, as the tools of neocolonialists, as is the American business and popular entertainment component.

Neo-colonialism entails simple influence over a sector of an undeveloped country by a more developed one. From imposition of English as the language of commerce everywhere, to imposing Coca-Cola and Disney and McDonald's as popular culture, to requiring that developing economies mimic the mature economies of the West or allowing multinational corporations access to compete with nascent indigenous ones—to the critics it all seems to be a matter of the Eurocentric world gaining advantage at the expense of the weaker partner in the third world, culturally or economically. It is the old, old colonialism, just under a new guise.

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## Colorado

COLORADO IS ONE of the Rocky Mountain states located in the west-central part of the UNITED STATES. All of Colorado is more than 3,300 ft (1,000 m) above sea level. With an average elevation of 6,800 ft (2,070 m), Colorado is the highest of all the states. *Colorado* is a Spanish word meaning “reddish colored” and was the name early Spanish explorers gave to the Colorado River when they first explored the region in the late 1500s. The state is bordered by WYOMING and NEBRASKA in the north, KANSAS and NEBRASKA in the east, NEW MEXICO and OKLAHOMA in the south, and UTAH in the west.

In the southwestern corner of the state, four state boundaries come together (New Mexico, ARIZONA, Utah, and Colorado) forming what is known as the Four Corners. Colorado, like Wyoming, is rectangular in shape with a combined area of 104,100 square mi (269,837 square km), making it the eighth largest of the 50 states. Colorado has 4,301,261 residents, ranking 24th among the 50 states. With only 41 persons per square mi (106 per square km), the state ranks 37th in population density. The state's 10 largest towns, all located in a 175-mi- (282-km-) long corridor along the Front Range from Fort Collins in the north to Pueblo in the south, account for 45 percent of the total population. Denver is the state's largest city as well as the capital.

The ROCKY MOUNTAINS, running from north to south through the middle two-fifths of the state, are the most dominant physical feature. In contrast, the eastern two-fifths of the state is part of the Great Plains, a relatively flat, treeless plain that extends from the mountains eastward to the Nebraska and Kansas state borders. To the west of the Rockies, the Colorado Plateau covers the remaining one-fifth of the land. In addition, Colorado includes small sections of two other natural regions, the Wyoming, or Green River, Basin and the Middle Rocky Mountains, both of which

lie in the extreme northwestern part of the state. Colorado also straddles the Continental Divide, which separates rivers flowing to the PACIFIC OCEAN and the Gulf of Mexico. Lands west of the divide whose waters flow to the Pacific are referred to as the Western Slope, while those to the east with waters flowing to the ATLANTIC are referred to as the Eastern Slope.

Five mountain ranges make up the Colorado Rocky Mountains: the Front Range, the Sangre de Cristo Mountains, the Park Range, the Sawatch Range, and the San Juan Mountains. The mountains are not part of a single highland area but are divided into two roughly parallel groups. The eastern mountain belt includes the Laramie Mountains, the Front Range, and part of the Sangre de Cristo Mountains. The highest peaks of these eastern ranges are Blanca Peak, Longs Peak, and Mount Evans, all of which are more than 14,250 ft (4,340 m) high. Pikes Peak, the state's most famous landmark at the southern end of the Front Range, rises to 14,110 ft (4,301 m). The western belt of high mountains includes the Park Range, the Sawatch Range, and the San Juan Mountains. The Sawatch Range contains Mount Elbert, the state's highest peak at 14,433 ft (4,399 m). The Sawatch Range and the San Juan Mountains combined contain 27 of the state's mountains over 14,000 ft (4,250 m).

Several broad, high-altitude valleys and mountain basins called parks separate the mountain belts from each other. The parks and valleys between the two mountain belts of the southern Rockies are broad, relatively flat, grass-covered areas. The principal ones are, from north to south, North Park, Middle Park, South Park, and the San Luis Valley.

The Great Plains region covering the eastern two-fifths of the state is a broad expanse of flat or rolling prairies that rise from about 4,000 ft (1,200 m) above sea level along the Kansas state line to approximately 7,000 ft (2,100 m) above sea level at the foot of the Rocky Mountains. The Great Plains region is not uniform throughout the state and is often divided into the High Plains, the Colorado Piedmont, and the Raton section. The High Plains are mostly level lands that extend along the eastern border with Kansas. The Colorado Piedmont, which lies to the west of the High Plains, is more varied in relief with low ridges, steep bluffs, flat-topped mesas, and conical hills referred to locally as called tepee buttes. The Raton section to the south of the Piedmont is more rugged, with numerous mesas and buttes of volcanic origin and narrow, rocky canyons that often appear out of nowhere. The plains region is primarily a dryland farming area used for

growing wheat and grazing cattle, although the use of irrigation has allowed an increase in corn and sorghum production in areas where groundwater is sufficient to support pumping.

### COLORADO PLATEAU

The Colorado Plateau occupies the western two-fifths of Colorado. Originally named by explorer John Wesley Powell, the plateau is in fact a huge basin ringed by highlands and filled with dozens of separate plateaus that range from about 5,000 to 11,000 ft (1,500 to 3,400 m) high. As a physiographic "province," the region is geologically and topographically distinct from other parts of the west remaining structurally intact for the past 500 million years or more. Sprawling across southeastern Utah, northern Arizona, northwestern New Mexico, and western Colorado, the Colorado Plateau covers a land area of 130,000 square mi (336,700 square km). Of America's 50 states, only ALASKA, TEXAS, CALIFORNIA, and MONTANA are larger. One of the plateau's unique features in Colorado is the Black Canyon of the Gunnison, a deep gorge cut by the Gunnison River that is deeper than its more famous neighbor, the Grand Canyon, in places.

Colorado's earliest inhabitants were Native Americans who settled in the mesa country more than 2,000 years ago. The first European to enter the region was probably the Spanish conquistador Francisco Vázquez de Coronado in the 16th century, with Spain claiming



*A scenic vista of Colorado State Park, in the Rocky Mountains, typifies Colorado's western region.*

the area in 1706. France also laid claim to the area as part of its Louisiana Territory, although no settlements were established. The United States bought the area north of the Arkansas River and east of the Rocky Mountains as part of the LOUISIANA PURCHASE in 1803.

Early expeditions to the area explored routes opened earlier by the famous mountain men, trappers, and fur traders. While Bent's Fort along the Arkansas River became one of the best-known trading posts in the region, settlement did not begin until the United States acquired the remainder of present-day Colorado from MEXICO in the Treaty of Guadalupe Hidalgo in 1848. It was the discovery of gold at Cherry Creek (present-day Denver) in 1858 that brought large numbers of settlers to Colorado. Interestingly, the area was part of the Kansas Territory at the time. Measures proposing statehood for Colorado were introduced in the U.S. Congress in 1864, although Congress did not pass the bill granting Colorado's statehood until 1876.

The mining booms of the late 1850s spurred Colorado's initial growth. The state's economy broadened when irrigated agriculture developed, and by the late 19th century, livestock raising had become dominant on the eastern plains. Early industrial growth was based on the processing of minerals and agricultural products. In the second half of the 20th century, the industrial and service sectors expanded as did winter resorts and summer recreational opportunities.

Manufacturing is dominated by the processing of local raw materials and by technology-dependent light industries. Leading manufactures include the production of scientific instruments, food processing, and the making of industrial machinery. The brewing of beer is the leading employer among food-processing industries, although the state has a diverse selection of industries preparing and packaging Colorado's farm output. Colorado is the nation's fourth-largest producer of cattle. The sale of livestock and livestock products (mostly cattle and calves) accounted for 72 percent of farm income in 2002. Western Colorado is the leading sheep-raising area in the state. The sheep are raised for both wool and meat, especially spring lambs. Hogs and dairy products contribute significantly to the state's agricultural economy as well.

Wheat is the leading cash crop, raised primarily on the High Plains. Corn is the second most important crop, although most of the corn is fed directly to livestock. In some plains areas, barley, grain sorghum, and oats are also grown, often in rotation with wheat. In addition, many stock farms raise both wheat and cattle. The production of fossil fuels is by far the most

valuable resource extraction, representing four-fifths of the state's mineral output and natural gas the leading individual mineral product. Most of this production takes place in the northwestern part of the state.

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## commercial agriculture

PRIOR TO THE FIRST AGRICULTURAL REVOLUTION, people relied on hunting and gathering to obtain food supplies. The agricultural revolution began as the individuals in the society began to cultivate soil, plant seeds, and use plows and animals to assist with the cultivation of the soil. This change from a hunting and gathering society did not occur in just one place but appeared almost simultaneously around the world. This first phase of the agriculture revolution took place approximately 10,000 to 12,000 years ago.

In the 17th century, a second agricultural revolution began. During this phase agriculture production and distribution increased, individuals became less dependent on growing crops themselves, and they began to move to the cities starting the INDUSTRIAL REVOLUTION. In the years between the first agricultural revolution and the second little changed with the way that agriculture was grown and harvested. It was during the second agriculture revolution that commercial agriculture was developed. This involved a shift from hand labor to machine farming. Between 1860 and 1910, the number of farms in the UNITED STATES tripled, from 2 million to 6 million, while the area farmed more than doubled.

The third revolution began in the 1920s with the development of fertilizers, chemical farming, and the



processing and refining of food. The main characteristics of this agricultural revolution were the blending of primary, secondary, and tertiary activities, intensification of mechanization, and development of biotechnology. One of the main elements influencing the third revolution was the green revolution, which is a process of technological development of agricultural techniques that began in Mexico in 1944 and has since spread throughout the world.

The agricultural revolutions and their main characteristics include:

*First revolution.* Before 10,000 B.C.E. in Europe and Southeast Asia: expansion of seed agriculture and the use of plow and draft animals; development of settlements, farming; population increase.

*Second revolution.* 1700s in western Europe and North America: production of an agricultural surplus and the development of commercial agriculture; closely associated to Industrial Revolution (begins in Britain; later spreads across Europe).

*Third revolution.* 1920s in western Europe and North America: development of agriculture, industry, chemical farming, and inorganic fertilizers (biotechnology); agriculture is related to processing and refining of foods.

Today, about 45 percent of the world's population makes its living through agriculture. The proportion of the population involved in agriculture ranges from about 2 percent in the United States to about 80 percent in some parts of Asia and Africa. Farming in the 20th century has become highly technological in the more developed nations, while less developed nations continue with using growing practices and methods that are similar to those developed after the first agricultural revolution.

## TWO TYPES OF AGRICULTURE

At present, there are two main types of agriculture: subsistence and commercial agriculture. Subsistence agriculture is defined as producing food primarily for local consumption (the farmer's family) and most often occurs in developing nations. Commercial agriculture is the production of crops for sale and is designed to produce crops for widespread distribution (supermarkets), larger markets, and export. It also extends to limited distribution (local produce stands) and any nonfood crops such as cotton and tobacco. It contributes substantially to the gross domestic product of a country.

Commercial agriculture is found in both the developing, developed, and the most the developed nations.



*The advent of corporate farms endangers the viability of the family farmer in developed and underdeveloped nations alike.*

This is now the predominant form of farming in Southeast Asia and throughout the world and includes major fruit plantations in Central America as well as enormous agribusiness wheat farms and facilities in the midwestern United States. In developed countries, farmers are involved in large-scale commercial farming, both rain-fed and under irrigation. In addition, they receive substantial government support aimed at increased domestic production and exports.

Agriculture was brought into the multilateral trade rules at the conclusion of the Uruguay Round and the establishment of the World Trade Organization (WTO) in 1995. Critics say the agreement tends to emphasize commercial as opposed to subsistence farming.

It is believed that a successful transition to a system of high-yielding commercial agriculture will open new opportunities for developing countries by allowing farmers to benefit from advanced technologies and expanded trade opportunities. However, not all farmers

will gain from these changes. Many small-scale subsistence farmers in more remote areas where the new technologies are less suitable may become more vulnerable and increasingly marginalized.

Since the beginning of the 1990s, there has been a considerable increase in the production of commercial cash crops. There has been a dramatic increase in the land planted to grow annual crops—cotton, jute, sugarcane, peanut, soybean, tobacco—as well as crops planted more than once a year: tea, coffee, rubber, peppers, coconut, and fruit crops. The farming of cattle and pigs has also increased.

### TECHNOLOGY

Rapid changes in technology are the characteristic of U.S. agriculture and a major force of contemporary commercial agriculture. Agricultural industrialization is a process in which the role of the farm has moved from the centerpiece of agricultural production into being only one part of the system of production. This also includes storage, processing, distribution, marketing, and selling the food. With agricultural industrialization, the farm becomes only one link in a large chain of food production.

In developing countries, mechanization and technological advances are not widely seen. This can be attributed to small land holdings, scattered plots, and poor rural infrastructure. Low income levels and the availability of cheap household labor also discourage households from either purchasing or renting machinery. Despite a government rhetoric encouraging industrialization and modernization, farm mechanization is hampered by a lack of positive government policies such as finance subsidies, low-interest loans for farm machinery, tax exemptions for the manufacturing of machinery and fuel to operate the farm machinery.

Other trends in commercial agriculture during the 1990s include consumerism, internationalization, environmentalism, policy change, and high technology. Historically, farmer's main objective was to keep up with the food demand generated by a growing population. However, over time, the population not only requires that basic energy requirements are met, but it is demanding better access to a wider variety of nutritious foods. Today's consumers are very concerned about the nutritional characteristics of the food as well as the safety of the food. With the increasing number of both men and women in the labor force, there is an emphasis on developing new products that not only meet the nutritional and the safety requirements but also increase the ease and speed of preparation.

Because of the size of the world market, internationalization is one of the fundamental forces affecting the well-being of U.S. farmers. In the international market many of the crops are characterized by: 1) marketing value-added products; 2) developing more alternative crops and more specialty crops; and 3) finding new ways to deliver those to foreign consumers in the form in which they want to buy. We live in a global market and a global society. This creates tremendous opportunities for the U.S. farmer to draw upon genetic material and new crops from other countries.

The third major trend of the 1990s is increasing concern for the environment. One of the goals is to provide modern agriculture with the best available, most environmentally friendly irrigation, prevention of soil erosion, and pest control.

The change is in the policy of farming or agriculture. There has been a decline in the role of "old-line" subsidy programs for corn, soybeans, wheat, cotton, and rice, programs that used to make up the most important elements of the U.S. agricultural policy. Instead, the new agenda is free trade, environmental conciseness, concern for the welfare of the animals that are farmed, and food safety.

Lastly, in the 1990s, agriculture is becoming an increasingly high-tech industry. There is a tremendous array of powerful tools of modern plant science at our disposal used to improve traditional crops through genetic manipulation and to find alternative means of pest control.

### PROBLEMS

Some problems with commercial farming include overproducing, harvesting fewer varieties of food, and limiting the ability of the small farmer to be able to earn a living.

Overproduction or an oversupply of food because of mass production has had a negative impact on both small and commercial farmers, as it often reduces their incomes. However, government policies often try to control overproduction through different means: paying farmers not to grow cash crops; providing price supports for products that are sold too cheap; and buying surplus production and then storing it, donating it, or destroying it.

With the global spread of commercial agriculture, fewer varieties of food are being planted in shrinking areas of arable land. Varieties of rice, corn, and wheat and new forms of livestock breeding have displaced many local varieties of crops and animal breeds. The United Nations Food and Agricultural Organization

(FAO) has estimated that more than 75 percent of agricultural crop varieties and more than 50 percent of domestic livestock breeds have disappeared over the past century because of modern farming methods. "The spread of modern, commercial agriculture and the introduction of new varieties of crops has been the main cause of the loss of genetic variety," explains an FAO report. When coupled with the rapid spread of commercial agriculture, market barriers, and the privatization of knowledge that has accompanied advances in biotechnology, the patenting of life forms poses a direct threat to the livelihoods of farmers and indigenous communities in developing countries.

In Asia, large resettlement schemes, intensive timber harvesting, and the expansion of commercial agriculture have been important agents of deforestation and forest degradation. The conversion of forest to plantations—both forest plantations and agriculture plantations of rubber and oil palm—has also been carried out on a large scale.

From a commercial perspective, the world hopes for greater security, protecting fragile environments and reforming local farm policies. To achieve this, developed countries must find less trade-distorting ways to support rural incomes and end the practice of subsidizing their exports. Developing countries need to embrace a similar vision of openness and allow imports as well as exports, as nearly half of global food trade, and virtually all of its growth potential, is among developing countries.

Second, the developed world needs to assist and encourage developing countries to build upon their capacity to participate in a global economy and to ensure that the rural farmers gain from globalization. Developed countries have pledged to reduce global hunger dramatically by increasing aid going to rural development and investing in commercial opportunities for developing country entrepreneurs. If these policies are appropriately supported by agricultural trade consortiums, the investment could increase and broaden the gains in a short amount of time instead of decades.

Finally, attitudes toward new technologies, especially agricultural biotechnology, need to be reexamined. New technologies can raise agricultural productivity and human nutrition at an affordable rate. It would be unfortunate if developing countries were denied these tools by trade barriers disguised as safety or marketing rules unsupported by science.

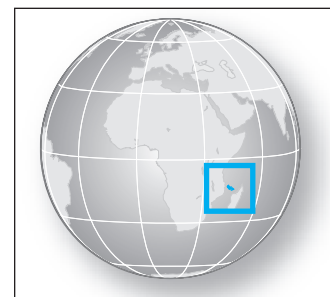
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## Comoros

**Map Page** 1116 **Area** 846 square mi (2,170 square km)  
**Population** 632,948 **Capital** Moroni **Highest Point** Le Kartala 7,788 ft (2,360m)  
**Lowest Point** 0 m **GDP per capita** \$720 **Primary Natural Resources** tourism, arable land, agricultural products.



COMOROS IS ONE of the world's poorest, and also most politically unstable countries. Located off the east coast of Africa, at the northern end of the MOZAMBIQUE CHANNEL, the Comoros developed under the mixed cultural influences of the Arab and East African world, plus European colonialism in the 19th century. The island group consists of Njazidja (also known as Grande Comore), the largest, with the capital of Moroni, plus the smaller islands of Mwali (Mohéli) and Nzwani (Anjouan). A fourth island, Mahoré (Mayotte), has retained its administrative links with FRANCE, despite intense local and international pressure. The islands have suffered from nearly 20 coups since independence in 1975, and further disintegration was heralded by proclamations of independence by two other islands, Mwali and Nzwani, in 1997. But a new attempt at compromise, promising a greater degree of local autonomy, was signed in 2001.

The islands of the Comoros are volcanic in origin and of varying ages. The most recently formed, Njazidja, has two major volcanoes, the extinct La Grille in the north (3,300 ft or 1,000 m), and Kartala in the south (7,791 ft or 2,361 m), which last erupted in 1977. Nzwani and Mwali are geologically older, and



have had time to form a richer soil from erosion and weathering. Most of the islands were formerly covered in lush tropical vegetation, and Nzwani and Mahoré have extensive coral reefs; both forests and reefs provide rich habitat for rare and interesting wildlife, such as the Livingstone fruit bat, the world's largest bat, with a wingspan of up to 6.6 ft (2 m), and the coelacanth fish, the "living fossil" with limblike fins, thought to have been extinct for 70 million years until its rediscovery in 1938.

Located on the TRADE ROUTES between the Arab world and East Africa, the islands were named by early Arab geographers *kamar* or *kumr*, meaning "moon." Early immigration from southeast Asia to MADAGASCAR left a small Malayo-Indonesian population, followed by immigrants from the East African coast, then settlements of Arab traders known as the Shirazi from the 15th century. This mixture of Malay, Arab, and African ethnic groups created the unique culture of the Comoros today and continues to manifest itself in strong ties to various states of the INDIAN OCEAN basin.

The Shirazi Arabs set themselves up as rulers and divided the islands into numerous sultanates. For many years they controlled much of the slave trade from east Africa to French plantations in Madagascar, MAURITIUS, and Réunion Island. Internal conflicts led to French occupation, first on Mahoré in 1841, then gradually over the other islands. The last sultan abdicated in 1912, and the islands became a formal part of the French colony of Madagascar until 1946. Internal self-rule was granted in 1961, followed by a referendum in 1974, in which 95 percent of the population voted for independence, but not on Mahoré, where 65 percent voted to remain part of France. This conflict, and the struggle between socialist and conservative Islamic groups, has resulted in the high political instability over the past four decades.

Economically, colonialism wrecked the Comoros, creating a system of near complete dependence on products not suitable for domestic consumption. After slavery was banned in French colonies in 1848, planters turned the islands into exclusive zones for rare tropical products, especially ylang-ylang (used in perfumes and soaps) and vanilla. The Comoros remains the world's largest producer of these two products, but is unable to feed itself and relies heavily on foreign aid, mostly from France, but increasingly from conservative Islamic states in the PERSIAN GULF. Islamic ties are strong, stressed in the official name, the Federal Islamic Republic of the Comoros, and symbolized by the crescent moon (from the name of the country) used in the

country's flag, which also stresses the desire for unity among all of the islands, depicting four stars, rather than three.

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## computer mapping

COMPUTER MAPPING IS the general term used to describe the process of developing digital maps from aerial photographs, satellite images, global positioning systems (GPS) records, paper maps, and other archival data sources. GEOGRAPHIC INFORMATION SYSTEMS (GIS) are currently the most common implementation of computer mapping systems. A GIS consists of an organized collection of computer hardware, software and trained personnel designed to capture and manipulate geographically referenced data for generating digital maps. Digital maps have the capacity to store information that is more detailed and allow the map features to link to external databases. One application of a GIS-based mapping system is automated mapping (AM), where digital inventory maps of facilities such as telephone and utility lines are linked to database information to aid in facilities management (FM). The overlaid system is known as AM/FM.

At the core of the computer mapping process is data capture, conversion, and verification. The availability of many forms of existing digital (such as satellite images and aerial photographs) and analogue (such as paper maps and statistical tables) data demands a level of flexibility to deal with these different formats during the mapping project. The general stages involved in computer mapping are to obtain the digital data, digitize any relevant analogue data, conduct a ground survey if necessary, align the digital data layers with a common reference system, and develop a continuous surface from the digital maps. The result is a spatial database that can be queried to support planning and decision-making goals.

Satellite images and aerial photographs are the most widely used inputs for many digital mapping projects. The computer-driven process of making the



raw satellite image and aerial photographs useful is termed *image analysis* or *photogrammetry*. These forms of raw data are already digital, and together with their affordable cost and frequency of collection, they provide significant advantages over other data sources. In addition, since the data is already in a digital format, errors based on data conversions are minimized. But in situations where data of high spatial resolution is required, such as for facilities planning using street networks, digitized maps and GPS data are needed to represent local-level map details.

The paper map is also a valuable input source for digital mapping projects. These paper maps are mostly topographic (showing earth features) or thematic (showing specific features), and drawn to a certain scale, and the attributes of features are encoded by colors and symbols. An important characteristic of the map is that geographic features are identified by a common coordinate or reference system. The common reference ensures that identical features are at the same coordinate position in all the digital database layers. This common referencing serves to integrate the various layers of the spatial database.

The process of manually entering data for use in a mapping project involves iterative stages of recording the spatial data, entering the attribute data, verifying the data entries, and linking the spatial and attribute data. For paper maps, a digitizer device, with its flat tablet and a connected cross-haired mouse, is used to trace each of the geographic features manually. At the particular map scale, all the features of interest on the map are encoded as points, lines, or areas, depending on how they are represented on the paper map. The final digital map elements are checked for correctness and may involve tasks such as verifying object shapes or field checks. A unique identification number is used to link the digital map objects to attribute data entered into a database. The discrete map objects consisting of points, lines, and areas are called vector data.

Document scanners are also used to convert analogue to digital data. The scanning process generates raster data as the paper map is captured as a two dimensional array of cells. The resolution of the digital data is characterized by the size of the cells. Each cell contains information about the component elements of the paper map. A smaller cell size (greater resolution), determined by the document scanner capabilities, means that any particular object on the map will be defined by more cells.

Issues such as increased computer storage requirements arising from more cells and the desired accuracy

of the digital map are challenges for this stage of the process. The scanned image will inevitably contain imperfections. Each grid cell needs to be encoded with information about the geographic feature it contains. Moreover, the image space must correspond to a map coordinate system. These tasks are accomplished with image analysis procedures that modify the cell attributes. The final digital map elements are checked for correctness and may involve tasks such as verifying object shapes or “ground truthing,” after which the image is ready for integration into existing spatial databases.

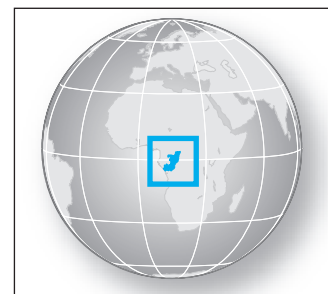
Georeferencing is an important part of creating the spatial database. During the georeferencing process, the raw digital data is projected so that the individual map objects are correctly arranged in some specified map coordinate system. The process begins by selecting identifiable objects on the digital map for which the real world (latitude/longitude) coordinates are known. The selected objects must be evenly distributed across the map surface as the georeferencing process uses them as fixed anchors to warp the entire digital map space to fit a selected coordinate system. A common coordinate referencing system ensures that all the map layers can be coupled.

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## Congo

**Map Page** 1115 **Area** 132,047 square mi (342,000 square km) **Population** 2,954,258 **Capital** Brazzaville **Highest Point** 2,963 ft (903 m) **Lowest Point** 0 m **GDP per capita** \$900 (2002) **Primary Natural Resources** petroleum, wood, potassium, potash, gold.



THE REPUBLIC OF Congo is located in western Africa and covers an area slightly smaller than MONTANA. It is bordered by GABON to the west, CAMEROON to the north, the Democratic Republic of the CONGO (formerly Zaire) to the east and south, the Angolan Cabinda enclave to the southeast, and the ATLANTIC OCEAN to the east. Congo's border with the Democratic Republic of Congo is the country's only natural boundary, which follows the CONGO and Ubangi rivers. Congo gained its independence from FRANCE on August 16, 1960.

Congo has a tropical climate that is warm and humid with heavy rainfall occurring mainly from March through June. Dense tropical RAINFORESTS start at the equator and cover the northern part of the country. South of the equator, there is a savanna area with diverse wildlife, including antelope, giraffe, cheetah, and crocodile, along with many birds and snakes. Also encountered in the southern part of Congo are central plateaus, fertile valleys, and coastal plain and forested floodplain areas.

In the Congolese valleys are grown the primary subsistence crops of cassava and yams. Export crops, raised on plantations in this area, consist of sugarcane, tobacco, coffee, cacao, palm products, rice, corn, and groundnuts.

### RIVER LIFE

Many of the rivers in Congo play a large part in the economic and commercial life of the Congolese people. There are over 2,300 mi (3,700 km) of navigable rivers in the country. The main river routes are along the Congo and Ubangi rivers. Brazzaville, the capital of Congo, is a large river port along the Congo River. Because of the effectiveness of transportation along the rivers and the vastness of the northern rainforests, the Congolese road system has barely been improved, and today consists only of 7,450 mi (12,000 km) of roads.

The Congolese forests constitute one of the major natural resources in Congo and are the primary agricultural export of Congo. These timbers were the top export of Congo before the discovery of oil in the country and now constitute only 7 percent of export earnings. The majority of these trees are oil palms and *okoume*. Oil was first discovered in Congo in 1957 at Pointe Indienne. Since then, oil has been Congo's largest export, making up 89 percent of the export earnings in 2001. At that time, the Republic of Congo was producing 275,000 barrels of oil per day.

Congo is one of the most urbanized countries of Africa with over 85 percent of its total population liv-

ing in the southwestern part of the country. Brazzaville has the highest population at over 800,000 people, followed by Pointe Noire with 450,000 people. The rest of the Congolese people live mainly in small cities or villages along the railroad connecting Brazzaville, located roughly 310 mi (500 km) inland along the Congo River, to Pointe Noire on the southern Atlantic Ocean. Along this railway lives more than 75 percent of the Congolese population. Even though Congo has a relatively concentrated population in these areas, the overall population density is low because vast areas of swamps and rainforest are uninhabited.

The ethnic diversity in Congo is also great. The Bantu people make up the majority of the population and include four groups. The largest group of the Bantu people is the Kongo, making up about 48 percent of the population. They are mostly farmers or traders, live primarily around Brazzaville, and speak Bantu. The Teke or Bateke, another Bantu-speaking group, make up 17 percent of the population. The remaining Bantu peoples are the Sangha and the M'Bochi. Also present in Congo are the country's first inhabitants, the Pygmies. There are fewer than 100,000 Pygmies in Congo today, and they live mainly in small tribal groups in the forests along the Congo River and in the rainforests north of the equator.

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## Congo, Democratic Republic of

**Map Page** 1115 **Area** 905,563 square mi (2,345,410 square km) **Population** 56,625,039 **Capital** Kinshasha **Highest Point** 16,765 ft (5,110 m) **Lowest Point** 0 m **GDP per capita** \$590 **Primary Natural Resources** diamonds, gold, silver, tin, bauxite.



THE DEMOCRATIC Republic of Congo (DRC) is strategically located as the geographic centerpiece of Africa. Smaller in area than only SUDAN and ALGERIA, the DRC is the third-largest country on the African continent and is slightly less than one-fourth the size of the UNITED STATES.

### ECONOMIC DISTRESS

Though possessing tremendous mineral resources, as well as the largest forest reserves and the largest hydroelectric potential in Africa, the DRC remains mired in economic distress owing to a history of exploitation. This exploitation began in 1885 when King Leopold of BELGIUM gained control of the area then known as the Congo Free State and treated the land and its people as his own personal fiefdom. In 1908, it became a colony of Belgium and remained under Belgian control until gaining independence in 1960.

Independence, however, did not bring an end to the troubles facing the DRC. Woefully unprepared for self-determination, the country quickly came under the dictatorial rule of Mobutu Sese-Seko. For the next 35 years, the DRC remained under Mobutu's corrupt and brutal control until a military occupation of Kinshasha ended his one-party rule in 1997. Yet the rewards of deposing Mobutu remained indeterminate, as the country has since been wracked with ethnic strife and civil war involving both internal and external forces. It is this continuing legacy of instability that has mired the Democratic Republic of Congo in a state of poverty.

### RICH RESOURCES

Despite being one of the poorest countries of Africa, the DRC could be one of the continent's richest. The CONGO RIVER basin and its vast resources dominate the country's landscape. Emanating from Lake Mweru in the far southeast, the Congo River crosses the equator twice before reaching the ATLANTIC OCEAN some 2,880 mi (4,630 km) later. Carrying the second largest volume of water in the world, the river could provide substantial hydroelectric power. Heavy annual rainfall averaging along the equator contributes to the river's flow, as well as to the equatorial rainforest covering more than 50 percent of the country.

The forest contains a tremendous variety of flora and fauna, including such rare animals as the gorilla. Further south of the equator, as well as to the highlands of the east, the rainforest gives way to savanna GRASSLANDS where lions, antelope, and giraffes can be found.

The size of the DRC, which offers such resource potential, also serves as a liability. With a predominantly rural population composed of over 200 major ethnic groups speaking more than 700 different languages and dialects, the Democratic Republic of Congo must improve its transportation and communication network. The country's population is clustered between the forest and highlands of the east, and in the strip of land stretching west from to the 25 mi (40 km) strip of coastline along the Atlantic Ocean through the capital of Kinshasha and into East Kasai.

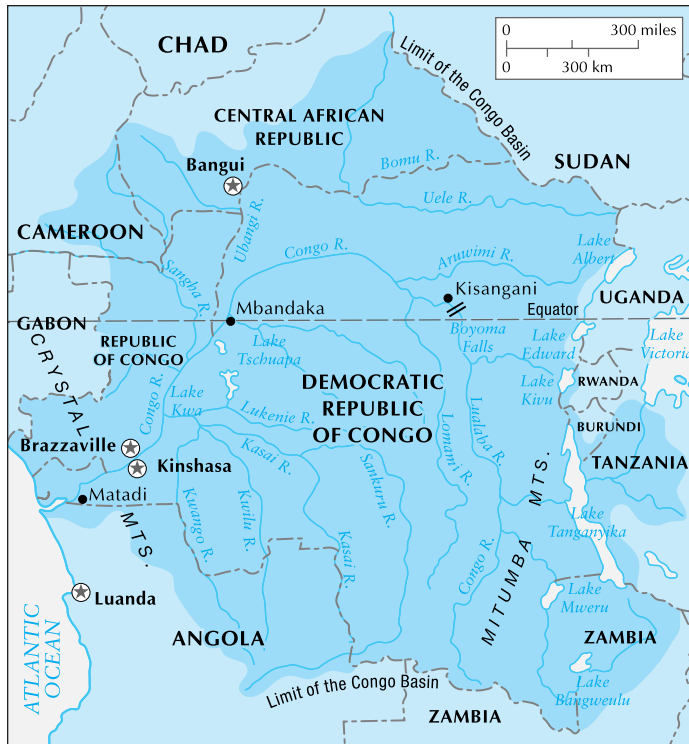
Most of the people are involved in subsistence agriculture and other primary activities, including mining. Cash crops, including coffee, cocoa, and palm oil, are also important, though difficult to export due to the country's woefully inadequate infrastructure. With a declining economy, a history of conflict and corruption, and billions of dollars in external debt, the Democratic Republic of Congo will remain faced with hardship into the foreseeable future.

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## Congo River

FROM ITS SOURCE on a savanna PLATEAU just south of Lake TANGANIKA, the Congo River flows some 2,880 mi (4,630 km) through equatorial africa before eventually emptying into the ATLANTIC OCEAN. While no other major river in the world transects the equator even once, the Congo River twice crosses the equator in its journey to the sea. The river flows through an immense and relatively flat drainage basin that lies more than 1,000 ft (300 m) above sea level. The Mitumba Mountains and the Ruwenzori Range form the eastern rim of the basin, while high plateaus rim the drainage basin in the north and south. A narrow westward outlet allows for the exit of the basin's surface water.



*Like its river and many tributaries in the region, the entire Congo basin is difficult to traverse.*

At 1.34 million square mi (3.46 million square km), the Congo River basin is the second-largest drainage basin in the world and receives an average of 60 in (152 cm) of rain annually.

This significant precipitation total is attributable to the fact that the river flows through both the Northern and Southern Hemispheres in a humid equatorial climate. As it is always the rainy season on one side of the equator, the Congo River avoids any notable change in volume from alternating wet and dry seasons.

By contrast, rivers in the savanna region of Africa often experience significant flow reductions during the dry season. Consequently, though only approximately 370 mi (600 km) longer than the NIGER RIVER, the Congo River discharges nearly eight times as much water into the Atlantic Ocean. Emptying into the ocean, the flow rate of the Congo River is second in the world behind only the AMAZON RIVER. However, as it is draining a basin in a humid equatorial climate, the tremendous discharge of the Congo River represents only 3 percent of its potential basin runoff.

Looping north and west in a great arc from its headwaters in the Katanga province, the Congo River receives input from several substantial tributaries. These rivers include the Kasai, Ubangi, Luvua, which

emanates from Lake Mweru in the far southeast, and the Lualaba, the principal stream of the upper course, considered by many to be the main branch of the Congo. In its relentless journey to the Atlantic Ocean, the width of the Congo varies from 3.5 mi (8 km) to 8 mi (12.8 km) and is divisible into three distinct sections—the Upper, Middle, and Lower Congo.

Characterized by waterfalls, lakes, and rapids, the Upper Congo includes a series of seven cataracts and rapids known as Stanley Falls. Extending over 60 mi (96 km), Stanley Falls demarcates the lower end of the Upper Congo and gives way to a lengthy stretch of navigable river along the Middle Congo. These navigable waters of the Middle Congo terminate just above Livingstone Falls and immediately downstream from the capital city of Kinshasha. A series of more than 30 cataracts, Livingstone Falls represents a turbulent 220 mi (354 km) stretch of the Congo River. Below the falls, the Lower Congo travels for approximately 200 mi (322 km) across the nearly level coastal plain before terminating in the Atlantic Ocean.

With an estuary approximately 7 mi (11 km) wide, the Congo River differs from other African rivers such as the Niger and the Nile in that it does not form a significant DELTA upon entering the ocean. However, it is similar to its African counterparts in that it has only limited navigability for significant portions of its course.

From its entry point into the Atlantic Ocean, for example, the Congo is navigable for only 85 mi (137 km) before reaching a series of rapids at the major fishing port of Matadi. Despite its inherent difficulty, river transport is an even greater necessity in the waters of the Congo than elsewhere in Sub-Saharan Africa. This same turbulence that renders many stretches of the Congo River impassable also contributes to the river's potential for hydroelectric power.

Owing to the speed and volume of its waters, the Congo River basin is the potential source of approximately 13 percent of the world's total hydroelectric power. Inga Falls, some 25 mi (40 km) upstream from the river port of Matadi, represents the largest hydroelectric power potential in Africa (and perhaps the world). Here water cascades downstream at a rate of 150,000 cubic ft (43,000 cubic m) per second as the river falls nearly 330 ft (100 m) in only 8.7 mi (14 km). Efforts to tap into the estimated 43,000 megawatts of generating capacity have thus far captured only a fraction of the potential power. Completion of two construction phases, Inga I (1972) and Inga II (1982), has netted only 1,700 megawatts of hydroelectricity. In



1999, plans for additional Inga stages were announced—with the ultimate objective being the capture of the entire power of Inga Falls by 2010. Despite its hydroelectric potential, concerns have been raised over the project's impact on the number of fish species and the viability of commercial inland fishing.

Like its river and tributaries, the entire Congo basin is difficult to traverse. Those pockets of the basin containing tremendous mineral wealth, including diamonds, cobalt and copper, have suffered intensive exploitation for decades. However, vast expanses of forest remain untouched and are home to such rare animals as the okapi and gorilla. Much of the forested basin has experienced only minimal human impact, such as when the Pygmies and other indigenous peoples use the forest for their hunting and gathering needs.

Agricultural activity typically includes the cultivation of bananas, maize, and sweet potatoes, as well as more commercially oriented crops such as coffee and sugar. Other economic activity involves raising goats and tending livestock. Despite only fairly limited economic exploitation of the region, the mineral wealth and hydroelectric potential of the Congo River basin are likely to attract increasing attention and activity in the future.

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## Connecticut

CONNECTICUT IS the southernmost of the New England states in the northeastern UNITED STATES and

has borders with MASSACHUSETTS in the north, NEW YORK in the west, and RHODE ISLAND to the east. There is also a very small area in the very northeast corner where Massachusetts extends south creating an eastern border. To the south, the Long Island Sound separates Connecticut from New York's Long Island, while Block Island and the Block Island Sound separate the coastal region from the ATLANTIC OCEAN.

The state has a roughly rectangular shape, extending approximately 90 mi (145 km) from east to west and 55 mi (90 km) from north to south. There is a very small protrusion in the southeast that juts into New York along the Long Island Sound. With an area of 5,009 square mi (12,973 square km), Connecticut ranks 48th nationally in size. With a population of 3,405,565, however, the state ranks 29th nationally in total population and is 4th in terms of population density, with 703 persons per square mile (1,821 per square km). But the high-density ranking does not mean there is not a rural feeling as you travel around the state. Most of the people live in or around Hartford (the capital) or within the corridor that extends southeast to New Haven (home to Yale University), Bridgeport (the largest city at 135,529) and New York. Overall, the state's 10 largest cities account for only 28 percent of the state's population.

The state is easily divided into three distinct regions on an east-west basis, plus a narrow coastal region running east-west that provides a north-south distinction. The land in the west is part of what is generally referred to as the Western Highlands, a landform that extends northward into Massachusetts and Vermont. Here the land slopes downward as you move south and east. Steep hills, sharp ridges, and numerous streams characterize the rugged beauty of the Berkshires, part of the Taconic Mountains in the very northwestern portion of the state between the Housatonic River and the New York border. The state's highest point of 2,380 feet (725 m) above sea level is here on the southern slopes of Mount Frissell, whose main peak at 2,453 ft (748 m) is on the Massachusetts side of the border. The heavily forested Eastern Highlands, which extend from the Connecticut Valley lowland northeastward to MAINE, are not as high as the Western Highlands.

Running north-south down the middle of the state following the Connecticut River is the Connecticut River Lowland, a narrow strip of land approximately 30 miles wide (48 km), characterized by numerous small rivers and low hills. The southern coastal lowlands run along the southern shores of the state where the land meets the Long Island Sound. The area varies

from 6 to 16 mi (10 to 26 km) wide, contains numerous beaches and small harbors, and, because of the protection offered by Long Island, has become a popular summer resort retreat.

## HISTORY

The Dutch were the first Europeans to explore the area when Adriaen Block sailed through Long Island Sound and explored the Connecticut River in 1614. By 1633, the Dutch had built a small fort near present-day Hartford, but the area was abandoned in the 1650s as more and more English settlers arrived. As the Puritans came in increasing numbers, the population expanded so that by 1662, when the colony received a legal charter from the English to exist as a corporate colony, there were more than a dozen towns. Connecticut was the fifth of the original 13 colonies to ratify the new constitution, officially becoming a state of the United States in January 1788.

After the Embargo Act of 1807 ruined the shipbuilding industry, manufacturing became the centerpiece of the state economy as increasing numbers of tradesmen came to the area. The manufacture of firearms was one of the mainstays of the economy in the late 1700s, as craftsmen worked to turn Connecticut iron into patriot guns. Eli Whitney, inventor of the cotton gin, opened the first modern factory to mass-produce materials when he founded a firearms factory to produce guns with standardized interchangeable parts at New Haven in 1798. Textiles, silverware, sewing machines, and clocks and watches were among the state's early manufactured goods. The insurance industry, long a key word associated with images of the state's economy and Hartford, had its beginnings in 1810 when the Hartford Fire Insurance Company opened its doors for business.

Today, although famed for its rural character and village atmosphere, most of the wealth in Connecticut is derived from industry. The state is an important producer of jet engines and parts, electronics and electrical machinery, computer equipment, and helicopters. Firearms and ammunition, first produced here at the time of the American Revolution, are still made, and Groton, where the first nuclear submarine was built in 1954, remains a center for submarine building.

Because much of the manufacturing is related to military spending, Connecticut's heavy industry remains subject to the periodic ups and downs of the U.S. military budget. Fortunately, the growth of financial, insurance, real estate, and service industries has more than offset any declines brought on by manufacturing

downturns, helping to turn the state into one of the wealthiest in the nation. Connecticut ranks first in both per capita income (\$40,702) and disposable income per capita (\$32,655).

Agriculture accounts for only a small share of state income. The state's major agricultural products include dairy products, eggs, vegetables, tobacco, mushrooms, and apples. High-grade broadleaf tobacco used in making cigar wrappers has been an important agricultural crop since the 1830s. The fishing industry is relatively small and has been hampered recently by pollution in the waters of the Long Island Sound. Stone accounts for most of the income derived from mining as it has since the 1800s when the Brownstone Quarries at Portland provided stones for mansions and public buildings.

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## containment

CONTAINMENT IS a political concept that served as the muted geopolitical battle cry for the UNITED STATES in the four decades of the Cold War (1947–89). It was first articulated in an embassy report from a young diplomat in Moscow dated February 22, 1946. In the “long telegram” George F. Kennan laid out a philosophical and conceptual framework for understanding the Soviet Union's approach to the world.

He pointed to a basic Russian psychic insecurity that underlay all their historic interactions with other nations, a sense of impending danger from the open STEPPE and a need for greater buffers and more impenetrable boundaries. Thus conflict with the Soviet Union was no shortcoming on the part of U.S. diplomacy but was more a perennial part of the Soviet perception of the outside world exacerbated by the flawed ideology of communism. Furthermore, it was the moral duty of the United States to stay its ground as the defender of personal liberty and democratic principles. This con-

flict was not a pragmatic case of give and take, rather a fight to the death between good and evil. Kennan called for a heroic struggle that had neither time limits nor geographical bounds.

This pathway of American moral imperative had powerful detractors from the beginning. Since it asked for the good fight to be fought at all points of the compass according to the “shifts and maneuvers of Soviet policy” it allowed no distinction between vital and peripheral interests. As the Truman Doctrine became a working reality around the world, Kennan’s view of political and economic containment gave way to the administration’s more martial strategy.

Sentiments from Europe embodied in the mighty voice of Winston Churchill called for the West to seek concession from the Soviet Union immediately while the U.S. atomic monopoly remained. Containment was patently defensive in nature, giving up the initiative to an aggressive adversary. Truman’s political opponents would call for a more aggressive “rollback” of the communist advance with a more proactive posture. The early criticism of former vice president Henry Wallace that questioned America’s moral right to wage an ideological and material war against communism, continued to plague the American mindset during the Cold War.

Kennan’s insights would become the basis of the Truman administration’s foreign policy. Stalin had proven to be an unreliable partner in the liberation and reconstruction of Europe. Instead the Kremlin chose to confound Western consolidation by instigating insurgency in GREECE and pressing communist parties to civil disobedience in Europe. As embers of discontent glowed among the ashes of Europe, Britain proved too weak to take up the crusade against a new threat to democracy.

The United States instinctively moved toward this moral challenge but needed more than the old world balance of power rationale. The administration saw the struggle against the Soviet Union as a struggle against two ways of life, a call to the protection of freedom everywhere. Here Kennan’s concept of containment gave an American vision and voice to the epic struggle. The Truman Doctrine took a moral high ground of supporting all free peoples who would resist subjugation by armed minorities or external forces. This meant immediate military and economic support to GREECE and TURKEY; Greece representing the European victims of World War II and Turkey the new American commitment to all nations struggling for freedom.

Each administration after Truman used the clarion call of containment as the framework of its foreign policy. Its lack of specifics regarding U.S. national interests caused much debate as to action. The countering of Soviet influence was seen to require the pouring of treasure into military bases around the world, the coffers of regional treaty organizations and power brokers, and weapons programs designed for the apocalypse. It also justified the shedding of blood in such diverse places as the Korean peninsula, the jungles of VIETNAM, and the islands of the CARIBBEAN SEA.

Former Secretary of State Henry Kissinger sees Kennan’s article rising to the level of historical philosophy, in calling the United States to a moral crusade heroic in proportion and idealistic in purpose. The United States could pursue its foreign policy in the spirit of righteously feeding the hungry, clothing the poor, and defending the weak. The Cold War has been won.

The Soviet Union dissolved and communism lapsed as a viable ideology among nations. Containment’s legacy in Europe is the NORTH AMERICAN TREATY ORGANIZATION (NATO), the EUROPEAN UNION, and the newly independent states of Eastern Europe eager to join in. The United States was left with an armed might of global proportions that was available for the handling of rogue regimes such as Iraq and AFGHANISTAN.

The concept of containment, in miniature, continues in the U.S. focus on an “axis of evil,” as U.S. President George W. Bush described Iraq, IRAN, and North KOREA.

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## continental drift

CONTINENTAL DRIFT INVOLVES large-scale horizontal movements of continents relative to one another

and to the ocean basins during one or more episodes of geologic time. The hypothesis of large-scale movement or displacement of continents has a long history. About 1800, Alexander von Humboldt, a German naturalist, noted the apparent fit of the bulge of eastern South America into the bight of Africa. On the basis of this observation, he theorized that the lands bordering the ATLANTIC OCEAN had once been joined. Half a century later, a French scientist Antonio Snider-Pellegrini argued that the presence of identical fossil plants in both North America and European coal deposits could be explained if the two continents were formerly connected, and was difficult to account for otherwise. In 1908, U.S. scientist Frank B. Taylor invoked the notion of continental collision to explain the formation of some of the world's mountain ranges.

Building on the previous arguments, the first comprehensive theory of continental drift was introduced by Alfred Wegener, a German meteorologist. It was unusual that it attracted worldwide attention, caused scores of scientific papers to be written attacking or defending it, and still has many staunch and convinced adherents despite numerous grave theoretical difficulties. It has long been known that the continental portions of the earth's crust consist chiefly of the lighter and more acid rocks; beneath this, it was commonly supposed, there was a layer of denser and more basic rocks.

### FLOATING CONTINENTS

Wegener essentially proposed that the lighter continents are floating on the denser underlying material. By bringing together a large mass of geological and paleontological data, he postulated that for a large part of geological history there was but a single land mass or continent that covered about one-third of the globe. He called that single continent Pangaea, which late in the Triassic period (245 to 208 million years ago) fragmented, and the parts began to move away from one another. Westward drift of the Americas opened the Atlantic Ocean, and the Indian block drifted across the equator to merge with Asia. One of Wegener's chief arguments was the assertion that eastern North and South America would fit well into the outlines of western Africa and Europe.

In 1937 Alexander L. Du Toit, a South African geologist, modified Wegener's hypothesis by suggesting two primordial continents: Laurasia in the north and Gondwanaland (or Gondwana) in the south. Aside from the congruency of continental shelf margins across the Atlantic, modern proponents of continental

drift have amassed impressive geological and seismological evidence to support their views. Indicators of widespread glaciation from 380 to 250 million years ago are evident in ANTARCTICA, southern South America, southern Africa, INDIA, and AUSTRALIA. If these continents were once united around the south polar region, this glaciation would become explicable as a unified sequence of events in time and space.

Also, fitting the Americas with the continents across the Atlantic brings together similar kinds of rocks and geologic structures. A belt of ancient rocks along the Brazilian coast, for example, matches one in Africa. Moreover, the earliest marine deposits along the Atlantic coastlines of either South America or Africa are Jurassic in age (208 to 144 million years old), suggesting that the ocean did not exist before that time.

In the 1950s, interest in the concept of continental drift increased as knowledge of earth's magnetic field during the geologic past developed from the studies of geophysicists Stanley K. Runcorn, P.M.S. Blackett, and others. Ferromagnetic minerals such as magnetite acquire a permanent magnetization when they crystallize as constituents of igneous rock. The direction of their magnetization is the same as the direction of the earth's magnetic field at the time and place of crystallization.

### REMNANT MAGNETISM

Particles of magnetized materials released from their parent igneous rocks by weathering may later realign themselves with the existing magnetic field at the time these particles are incorporated into sedimentary deposit. Studies of the remnant magnetism in suitable rocks of different ages from all over the world indicate that the magnetic poles were in different places at different times. The polar wandering curves are different for the various continents, but in important instances such differences are reconciled on the assumption that continents now separated were formally joined. The curves for Europe and North America, for example, are reconciled by the assumption that the latter has drifted about 30 degrees westward relative to Europe since the Triassic period.

Increased knowledge about the configuration of the ocean floor and the subsequent formulation of the concepts of seafloor spreading and the theory of PLATE TECTONICS provide further support for the theory of continental drift. During the early 1960s, the American geophysicist Harry H. Hess proposed that new oceanic crust is continually generated by igneous activity at the crests of mid-ocean ridges, submarine mountains that



flow a sinuous course of about 37,000 mi (60,000 km) along the bottom of the major ocean basins. Molten rock material from the earth's mantle rises upward to the crests, cools, and is later pushed aside by new intrusions. The ocean floor is thus pushed at right angles and in opposite directions away from the crest. By the late 1960s, several American investigators, among them Jack E. Oliver and Bryan L. Isacks, had integrated this notion of seafloor spreading with that of drifting continents and formulated the basis for plate tectonic theory. According to the later hypothesis, the earth's surface, or lithosphere, is composed of a number of large, rigid plates that float on a soft (presumably partially molten) layer of the mantle known as the asthenosphere. The margins of the plates are defined by narrow bands in which 80 percent of the world's earthquakes and volcanoes occur. There are three types of boundaries.

The first of these is a very narrow band of shallow earthquakes caused by tensile stresses that follow exactly the crest of the 49,000-mi- (80,000-km-) long, active midocean ridges. The second boundary type occurs in areas where these ridges are offset. Earthquakes are much more violent along fault lines at such sites and results from the plates on either side of the faults grinding literally past one another in opposite directions.

Earthquakes forming the third boundary are distributed more diffusely but include all the world's deep earthquakes, that is, those originating at depths greater than 90 mi (145 km) and are associated with extremely narrow zones where the ocean floor descends below its normal depth to as much as 6.5 mi (10.5 km) below sea level—oceanic trenches. Across this margin, the maximum earthquake depths systematically increase along a dipping plane, with shallower earthquakes associated principally with the volcanic activity that borders each trench.

The ridge-crest earthquakes originate because of the tension created when the plates on either side move in opposite directions. This movement also releases the pressure on the underlying hot rocks, causing them to begin melting. The resulting magmas rise to form volcanoes (such as those in ICELAND), which then solidify and later fracture as the tensional forces reassert themselves. Such new volcanic rocks thus become added to the edge of each plate, which grows at these “constructive” margins.

The evidence for plate motion is not only the nature of the earthquakes but also the age of the volcanic oceanic rocks. Dating can be achieved by using both the fossil contents of the sediments overlying the vol-

canic rocks and the time record represented by the anomalies in the magnetism of the rocks, which can be detected by ships sailing on the ocean surface. These show that the youngest volcanic rocks are at the crest of the midocean ridges and the oldest are in the deepest areas, that is, the oceanic trenches. Nowhere, however, are such rocks older than 190 million years, indicating that all older oceanic rocks must have been destroyed.

The midocean ridges occur along some of the plate margins. Where this is the case, the lithospheric plates separate and the upwelling mantle material forms new ocean floor along the trailing edges. As the plates move away from the flanks of the ridges, they carry the continents with them. On the basis of all these factors, it may be assumed that the Americas were joined with Europe and Africa until approximately 190 million years ago, when a rift split them apart along what is now the crest of the mid-Atlantic Ridge. Subsequent plate movements averaging .8 in or 2 cm per year have brought the continents to their present position.

Although the lateral extent of the plates is well defined, their thickness is less certain. At the crest of the oceanic ridge they are very thin, but heat-flow and seismic evidence suggest that the basin increases rapidly with depth, reaching 30 to 36 mi (48 to 57 km) within about 6 to 12 mi (9 to 19 km) of the crest. By about 597 mi (960 km) distance from the crest, the basin has increased to 71 mi (115 km). A plate may be subducted at any thickness but rarely exceeds 90 mi (145 km). Moreover, the presence of volcanic rocks indicates that here the Earth's lithosphere is at least 118 mi (190 km) thick, so that mantle flow, which causes plate motions, must occur at even greater depths. It seems likely, though still unproven, that the breakup of a single landmass and the drifting of its fragments is merely the latest in a series of similar occurrences throughout geologic time.

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## continental shelf

A CONTINENTAL SHELF is the submerged top of the continent's edge, lying between the shoreline and the continental slope that forms a border to a continent. In other words, the surface of the Earth lies at two general levels: a lower, which is the floor of the ocean basins, and an upper, the parts of which are the continents. Between these two levels is a comparatively narrow slope. The volume of ocean water is, however, a little too great to be entirely contained in the ocean basins, and so it must lap over somewhat on the lower, outer edges of the continental platforms. Such a submerged outer edge is called the continental self. The shelf is made shallower by deposition of material eroded from the land. The shelf has a gentle slope and is the shallowest portion of the ocean. Usually, a shelf is less than 650 ft (200 m) deep; in ANTARCTICA the continental shelf averages 1,650 ft (500 m).

The continental shelves are the regions of the oceans best known and the most exploited commercially. It is this region where virtually all of the petroleum, commercial sand and gravel deposits, and fishery resources are found. It is also the locus of waste dumping. Changes in sea level have alternately exposed and inundated portions of the continental shelf. A continental shelf typically extends from the coast to depths of 330 to 600 ft (100 to 200 m). In nearly all instances, it ends at its seaward edge with an abrupt drop called the shelf break. Below this lies the continental slope, a much steeper zone that usually merges with the section of ocean floor called the continental rise at a depth of roughly 13,000 to 16,000 ft (4,000 to 5,000 m).

The shelf varies greatly in width, but it averages about 40 mi or 65 km. Almost everywhere it represents simply a continuation of the land surface beneath the ocean margins; hence, it is broad and relatively level offshore from plains, and narrow, rough, and steep off mountainous coasts. For example, the shelf along the mountainous western coast of the United States is narrow, measuring only about 20 mi or 32 km wide, whereas that fringing the eastern coast extends more than 75 mi or 120 km in width. Exceptionally broad shelves occur off northern AUSTRALIA and ARGENTINA.

The continental slopes begin at the shelf break and plunge downward to the great depths of the ocean basin proper. Deep submarine CANYONS, some comparable in size to the GRAND CANYON of the Colorado River, are sometimes found cutting across the shelf and slope, often extending from the mouths of terrestrial rivers. The CONGO, AMAZON, GANGES, and HUDSON

rivers all have submarine canyon extensions. It is assumed that submarine canyons on the continental shelf were initially carved during periods of lower sea level in the course of the ice ages. Their continental slope extensions were carved and more recently modified by turbidity currents—subsea “landslides” of a dense slurry of water and sediment.

Some parts of the world's continental shelves are extremely level (for example, the parts off the Arctic coast of SIBERIA), but more commonly, they exhibit some relief. Close to the coast of New England are submerged glacial deposits. In places, ridges or cliffs can be traced from the land onto the continental shelf. Usually continental shelves are covered with a layer of sand, silts, and mud. In a few cases, steep-walled V-shaped submarine canyons cut deeply into both the shelf and the slope below. Some of them connect with a system of land valleys, but their origin is one of the great scientific puzzles.

Many continental slopes end in gently sloping, smooth-surfaced features called continental rises. The continental rises usually have an inclination of less than half a degree. They have been found to consist of thick deposits of sediment, presumably deposited as a result of slumping and turbidity currents carrying sediment off the shelf and slope. The continental shelf, slope, and rise together are called the continental margin.

Since the 1970s an increasing number of investigators have sought to explain the origin of continental shelves and their related structures in terms of PLATE TECTONICS theory. According to this theory, the shelves of the PACIFIC OCEAN, for example, formed as the leading edges of continental margins on lithospheric plates that terminate either at fracture zones (sites where two such plates slide past each other) or at subduction zones (sites where one of the colliding plates plunges into the underlying partially molten asthenosphere and is consumed, while the overriding plate is uplifted). Shelves of such origin tend to be steep, deformed, and covered by a thin layer of erosional debris. The Atlantic continental shelves, on the other hand, show little or no tectonic deformation and bear a thick veneer of sedimentary material.

They are thought to be remnants of the trailing edges of the enormous plates that split apart and receded many millions of years ago to form the Atlantic basin. As the edges of the plates gradually contracted and subsided, large amounts of sand, silt and mud from the continents settled and accumulated along the seaward side.

The Outer Continental Shelf (OCS) consists of the submerged lands, subsoil, and seabed, lying between the seaward extent of the states' jurisdiction and the seaward extent of federal jurisdiction. The continental shelf is the gently sloping undersea plain between a continent and the deep ocean. The United States OCS has been divided into four leasing regions. They are the Gulf of Mexico OCS Region, the Atlantic OCS Region, the Pacific OCS Region, and the Alaska OCS Region. In the United States in 1953, Congress designated the secretary of the interior to administer mineral exploration and development of the entire OCS through the Outer Continental Shelf Lands Act (OCSLA).

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## continentality

**CONTINENTALITY** IS A climatic effect that results from a continental interior being insulated from oceanic influences. Winds and air masses of moderate temperature that originate over oceans move onshore to diminish differences in winter and summer temperatures in coastal areas of continents. Interiors of continents are too distant to experience the moderating effect. As a result, climates of continental interiors have great seasonal differences of temperatures and a mean annual temperature below the latitudinal average. Continental interior climates also tend to be subhumid to arid, as oceans are primary sources of atmospheric moisture.

Alexander von Humboldt, the celebrated 19th-century German geographer, was the first person to provide empirical proof that the climate of continental interiors differs from that of coasts. Through letter writing and extensive travels, he collected enough weather station data to draw the first world map of isotherms. (Isotherms are lines that join points of equal temperatures, and their patterns on a map reveal temperature trends over distance.) After examining the

map, von Humboldt concluded that continental climates are colder in winter and warmer in summer than places near oceans at the same latitude. He popularized the term *continentality* to describe the effect that a location's distance from an ocean has on its mean annual range of temperature.

Since von Humboldt's time, geographers and scientists have used other climatic elements to measure continentality, including precipitation, wind, and air mass frequency. Nevertheless, the most widely accepted criterion remains the mean annual range of temperature, which is the difference between a location's warmest and coldest average monthly temperatures. This facile calculation is a clear-cut expression of how climates of inland and coastal areas differ.

The spatial variation of the mean annual range of temperature is a result of differential heating of air by land and water. The differences in summer and winter temperatures over land and water are greatest.

In summer, air temperature over the ocean is cooler than over the land. There are several reasons for the difference. First, chemically, water has a higher specific heat than land does, meaning water must absorb more solar energy than rock and soil in order to be raised the same number of degrees in temperature. Water also heats more slowly than land does because solar energy passes tens of meters below the water surface before it is absorbed completely. Land heats up faster than water because heat conducts only a few inches (centimeters) and feet (meters) into the ground. Additionally, water stores heat at even greater depths than land does, as downwelling of water distributes absorbed energy hundreds of meters below the surface. Water undergoes high rates of evaporation in summer, which cools air temperatures by transferring sensible heat of water into air as nonsensible heat of vaporization.

In winter, the ocean is still in the slow process of transferring heat energy stored during the summer into the atmosphere. The belated transfer makes air over the ocean relatively warmer than that over land; conversely, winter air over land is cooler because summer heat is stored closer to the ground surface, causing land in winter to cool air faster and to a lower temperature than water does.

A main influence on the mean annual range of temperature on land is distance from the oceans. Three cities on the North European Plain that are progressively farther inland illustrate the effect. Antwerp, BELGIUM, is nearest the Atlantic Ocean; Warsaw, POLAND, is a mid-distance away; and Saratov, RUSSIA, is farthest from the ocean. In this example, latitude, which affects

sun angle and therefore intensity of solar energy, does not explain differences in mean annual temperature ranges of the cities, as the three are less than 1-degree latitude apart (between 51 degrees N to 52 degrees N). Therefore, distance from the ocean is the only major factor that could explain the differences.

The plain's open terrain gives all three cities potential access to the moderating effects of the westerlies, a belt winds that blows across the ATLANTIC OCEAN and carries marine heat and water vapor inland. However, temperature data show that the size of the mean annual temperature range increases with distance from the ocean. Antwerp's mean range is 26.6 degrees F (14.8 degrees C); Warsaw's is 35 degrees F (19.5 degrees C); and Saratov's range is 59.3 degrees F (32.9 degrees C). Antwerp has a moderate temperature range because it is within 50 mi (80 km) of the sea. Saratov's range is more than double Antwerp's because it is 1,600 mi (2,700 km) inland. Warsaw's temperature swing is between the two extremes, owing to its middle-distance location of 600 mi (950 km) from the ocean.

Mountains influence continentality by limiting the distance that maritime winds can enter continents. For example, NEVADA is coastal CALIFORNIA's inland neighbor and not far from the Pacific Ocean. However, the Sierra Nevada of California add to the continentality of Nevada by blocking marine air of the westerlies from the ocean. The absence of the ocean's humidity in Nevada leads to fewer clouds there. Clearer skies means Nevada has greater solar heating in summer and radiation cooling in winter than it would have if mountains were not present to block ocean air from entering. Additionally, blocking of moist ocean air causes aridity in Nevada.

Latitude also influences continentality. In the tropics, annual temperature swings usually are small even in continental interiors. In middle latitudes of the Northern Hemisphere, the continental effect is an overriding factor in climates of continents, as average annual temperature ranges increase with increasing latitude there. In the middle latitudes of the Southern Hemisphere, the effect of continentality is smaller, as continental areas are less massive in that part of the world.

In areas poleward of the middle latitudes, the polar night and ice cover introduce complications, so it is difficult to separate influences of land or sea in terms of temperature or other climate variables. Climate scientists have developed several formulas to correct temperature range for polar latitudes.

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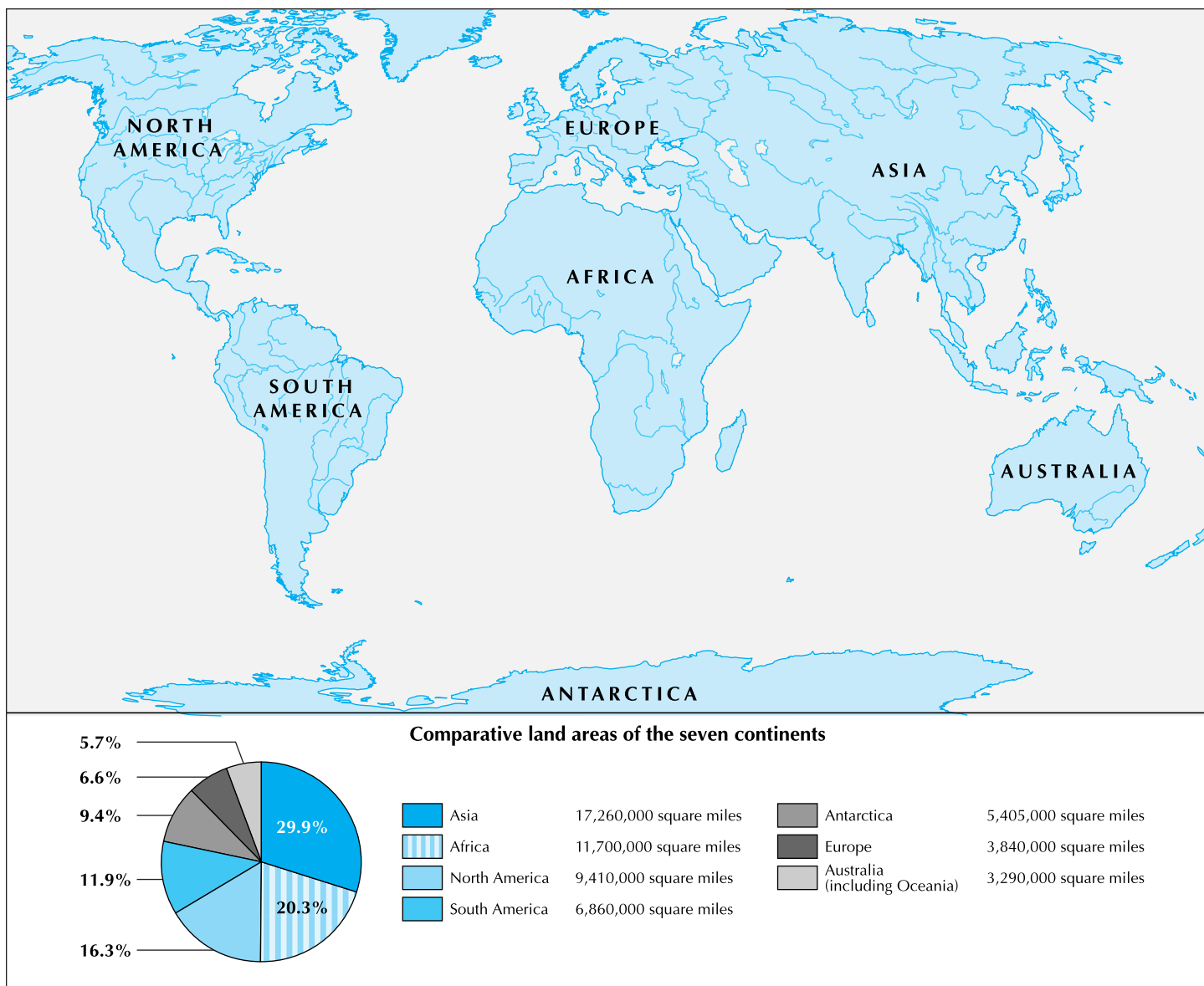
## continents

THE EARTH IS AN ocean-dominated planet. Only one-third of the planet's surface is dry land. The Earth's land areas include innumerable islands and several larger expanses of land termed continents. A continent is defined as a mass of land significantly larger than an island, completely or nearly surrounded by ocean water. By common agreement among geographers, the Earth's smallest continent is AUSTRALIA while the Earth's largest island is GREENLAND. Australia's area is about 2,966,000 square mi (7,682,000 square km), while the area of Greenland is approximately 836,000 square mi (2,165,000 square km).

The outermost rock layer of the earth is termed the crust. The oceanic crust is composed almost entirely of basalt, a dense igneous rock. The earth's continental crust, in contrast, is composed largely of lighter granitic rock. The continental crust varies greatly in thickness but averages about 35 mi (56 km) thick. The oceanic crust, in contrast, averages only about 4 mi (6 km) thick. Because of the imprecision of the definition, geographers do not agree on the number of the earth's continents. Geographers in the United States commonly recognize seven continents: Asia, Africa, North America, South America, Antarctica, Europe, and Australia.

The ancient Greeks recognized three continents bordering and surrounding the MEDITERRANEAN SEA (the "sea in the middle of the lands"). Africa was almost completely separated from Asia by the RED SEA, while Asia was separated from Europe by the AEGEAN SEA, the Dardanelles, the Sea of Marmara, the Bosphorus, and the BLACK SEA. In later centuries, when exploration revealed that Europe was in reality not a separate landmass, Europe was redefined to include extensive land boundaries—in violation of the generally accepted definition of a continent. The boundary between Europe and Asia is now generally accepted to begin at the Aegean and to continue through the Dard-





anelles, the Black Sea, the CAUCASUS MOUNTAINS, the CASPIAN SEA, the Ural River, and the URAL MOUNTAINS. The Ural Mountains thus separate European Russia from Siberia.

In lists of continents compiled outside the United States, Europe and Asia are often combined as Eurasia. And since Africa and Asia are connected at the Suez Peninsula, Europe, Africa, and Asia are sometimes combined as Afro-Eurasia or Eurafrasia. The International Olympic Committee's official flag, containing five interlocking colored rings, symbolizes the five continents that send athletes to the Olympic Games: Europe, Asia, Africa, Australia, and the single continent of America (North and South America being connected at the Isthmus of Panama). Antarctica, the uninhabited continent, is unrepresented. In modern times, artificial

canals have been dug to connect oceans at both Suez and PANAMA. Along with the Red Sea, the Suez Canal is now sometimes said to separate Africa from Asia. The PANAMA CANAL, likewise, is sometimes considered to mark the boundary between the North and South American continents.

All of the continents except Antarctica are roughly triangular in shape, narrower in the south than in the north, a consequence of the way the early super-continental landmass of Pangaea broke apart. Two-thirds of the landmass of the continents occurs in the Northern Hemisphere, particularly in the hemisphere centered on Europe. The large landmass of Eurasia is balanced on the other side of the globe by the large water mass of the South PACIFIC OCEAN. The continental landmass of Antarctica is countered by the ARCTIC OCEAN.



U.S. Navy ships transit the Suez Canal, which is often used to demarcate the continents of Asia and Africa.

A subcontinent is a subdivision of a continent, a large peninsula that may be separated from the rest of the continent by geographic features of some kind. The most widely recognized subcontinent is the Indian subcontinent, the large peninsula jutting southward from the mass of Asia, isolated from the rest of Asia by the HIMALAYAS. In British English, “the subcontinent” usually refers to INDIA, PAKISTAN, BANGLADESH, and adjacent areas—in the same way that to the British “the continent” refers to the continent of Europe. If one considers Eurasia a continent, though, Europe is merely a subcontinent attached to the larger continental landmass. Other subcontinents might include the Arabian Peninsula of southwestern Asia, the southern cone of South America, and ALASKA (the northwestern peninsula of North America).

Continents are fringed by CONTINENTAL SHELVES, offshore areas of relatively shallow oceanic water. Shallow waters, with depths up to 600 ft (180 m), roughly follow the outline of the continents, up to the point where the continental slopes quickly drop off to the usual oceanic depths of 12,000 ft (3,660 m) or so. In places such as the Grant Banks east of Newfoundland, the continental shelf can be 250 mi (400 km) wide. In other places, especially along tectonically active coastlines such as CALIFORNIA, the continental shelf may be almost nonexistent.

A continental divide is the line along the backbone of a continent separating the drainage basins of the oceans surrounding that continent. The continental divide of North America follows the ROCKY MOUNTAINS

from Alaska south to MEXICO, and is then continued through Mexico’s Sierra Madre Occidental and the mountains of Central America to Panama. Streams to the west of this divide feed rivers that run to the Pacific Ocean. Streams to the east flow eventually to the ATLANTIC OCEAN or to its connecting seas (Hudson Bay, the Gulf of Mexico, or the CARIBBEAN SEA).

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## Cook Islands

PART OF NEW ZEALAND, the Cook Islands consist of 15 islands in the south PACIFIC OCEAN, about halfway between HAWAII and NEW ZEALAND. They are about the same size as RHODE ISLAND. The islands are scattered over an area of more than 706,566 square mi (1.83 million square km). The nine islands in the southern group were formed by volcanic material escaping from a fracture in the Earth’s crust. Most of the population lives on these fertile islands. The northern islands are low coral atolls. The mountainous Rarotonga in the southern group is the largest island.

The Cook Islands have a tropical climate, moderated by trade winds, similar to Hawaii’s climate. It is often sunny, and the rains, although sometimes heavy, don’t last long. Hurricanes can occur during their summer, from December to March. The interior of Rarotonga is the wettest place in the islands. The highest temperatures, averaging 84 degrees F (29 degrees C), occur during the wet season. In the coolest months, the average daily high temperature is 77 degrees F (25 degrees C). Lush vegetation grows on the Cook Islands. Tall trees, creepers, and ferns grow in the interior. Food plants, such as coconuts, bananas, and grapefruit are found on the coast. Yams and taro are important food crops.

Most Cook Islanders are of Polynesian background, although a few people are a mix of Polynesian and other cultures. The Polynesians belong to the Maori branch of the Polynesian race and are related to

the Maoris of New Zealand. The official languages are English and Maori, and most people speak both. The overwhelming majority of the people are Christian. Most belong to the Cook Islands Christian Church, founded in the 1820s by missionaries. Cook Islanders are excellent dancers. Traditional music is also popular. Islanders compete in dance and singing competitions. String bands use a combination of electronics and traditional instruments fashioned from coconut shells. Visitors can choose from a large selection of arts and crafts made by the Islanders. Popular items include coconut-fiber hats, brightly-colored wraparound clothing, wood carvings, and pottery. Woven mats and blankets are also in demand, as are carved bowls.

Avarua, located on Rarotonga, is the nation's capital and largest town. Although it is a typical small tropical town, it boasts a gallery, the National Cultural Centre, and a branch of the University of the South Pacific. A number of small villages are scattered around the islands.

The Cook Islands have been occupied by the Polynesians for 1,500 years. Captain James Cook discovered some of the islands in 1773. Missionaries from London, converted most of the islanders to Christianity. The islands were a British protectorate from 1888 until 1901, when they were annexed by New Zealand. Although still officially a part of New Zealand, the islands are self-governing.

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## core and periphery

CORE AND PERIPHERY are terms used in geographic models to describe areas of differing economic production and political power and can be applied to both intra- and interstate variations. Core areas are described as the engines of economic growth and are characterized by modern, technologically advanced production methods as well as highly skilled and high-wage labor. Places using low-technology production methods accompanied by low skill and low-wage labor, on the other hand, are labeled the periphery.

Within the discipline of geography, the terms *core* and *periphery* are more common in the subdiscipline of political geography as compared to economic geography, where they have been deemphasized in favor of more complex notions of flows and processes.

The concepts of core and periphery can be applied to various scales. At the interstate scale, examples of core areas are the UNITED STATES, the countries of Western Europe, and JAPAN. In these countries goods are produced using technologically complex methods, wages are high, and the labor force is relatively educated and skilled.

Countries like CAMBODIA, BANGLADESH, and most of Sub-Saharan Africa are examples of the periphery, where technologically simple, labor-intensive, low-skill, and low-wage occupations predominate. These are broad generalizations and within a country there can be areas of core processes and areas of peripheral processes. In the United States, for example, Silicon Valley in CALIFORNIA is a core area where high-technology businesses are clustered. Appalachia, on the other hand, is a peripheral area where technology is less complex and wages are low. Going down to even smaller scales, within a city core and peripheral areas can be spatially designated. In NEW YORK CITY, Wall Street and the financial district would represent a core area and some of the underdeveloped neighborhoods in the outer boroughs would be considered peripheral.

Although core and peripheral areas are often mapped, they are not place-based phenomena, but rather are characterized by the production processes present. Therefore, where core and peripheral processes are located, as well as what constitutes core and peripheral processes, can change over time. In each particular historical era core processes are the most technologically advanced production methods present. In the 19th century, core processes were characterized by the industrialized mass production of goods, such as textiles, in places like Manchester, England. In the present day, however, textile production is a peripheral production process common in countries of the global south. More technologically advanced computer and financial businesses predominate in core areas.

### THEORIES OF CORE AND PERIPHERY

The terms *core* and *periphery* are used in many contexts, but surprisingly the two main theories of core and periphery disagree on what the outcome of this economic differentiation will be. On the one hand, exchange-based theories of core and periphery predict long-term lessening of economic inequalities as core

areas develop the periphery and bring it up to an equal economic level. On the other hand, world systems theory predicts that the uneven development will be maintained as core areas exploit the natural resources, both commodities like timber and coal as well as cheap labor, in peripheral areas, which will further economic disparities.

### WORLD ECONOMY

The exchange-based model of core-periphery relations is often associated with the writings of John Friedmann (1966), who first noted these economic differences in VENEZUELA. Exchange-based models rely on the notion that market forces, if undisturbed by state regulation, will eventually result in spatial economic equality. These theories suggest that the cheaper costs of labor and raw materials in peripheral areas will encourage businesses to invest there, which will bring development. This idea, often known as developmentalism, is the underlying theory used by most governments in the world and by international organizations like the World Bank (WB), the International Monetary Fund (IMF), and the World Trade Organization (WTO) to promote free trade and economic reforms involving the deregulation of markets.

Critics of developmentalism have pointed out that over time economic disparities have widened rather than converging as the exchange-based models predicted. As an alternative, these scholars suggest world systems theory, also known as the world economy model, to explain core-periphery economic development. World systems theory was first proposed by Immanuel Wallerstein (1974) as a model to explain the persistence of worldwide economic disparities historically. The world economy model focuses on the role countries play at the global scale and argues that there is one world economy driven by capital accumulation that has been in place for approximately the last 500 years.

A unique aspect of the world economy model is the way power is understood. The model suggests power is derived from a country's ability to control situations through active force (waging war), latent force (threatening action), non-decision making (avoiding issues by never discussing them), and structural position. Core countries utilize their structural position by setting market prices and wages, controlling the economic agenda through international organizations (WB, IMF, WTO), and promoting free trade and open borders.

Technological advances are likely to occur only in the core because of the superior infrastructure present,

which maintains the core countries' structural advantage. Consequently, in the world economy model, the core is often described as the exploiter and the periphery as exploited.

World systems theory also adds a third category, the semi-periphery, which mediates between core and peripheral areas, stabilizing the system. The semi-periphery, rather simply, is characterized by both core and peripheral processes. At the interstate scale, countries like SOUTH AFRICA or INDIA are currently examples of this intermediate level. In India, core processes are present in cities like Bangalore and Mumbai where high technology businesses are clustered. However, in other parts of India there are millions of people who work in subsistence agriculture and earn less than one dollar a day.

Critics of the world economy model point out that although the model suggests that the core has a structural advantage that allows it to maintain, and even strengthen, its position through unequal exchange of capital, several countries have been able to escape the periphery. Recent examples are countries like SINGAPORE and South KOREA, which have increased their gross domestic product rapidly in the past 50 years. Additionally, the United States, which is the strongest state in the core today, was a peripheral country 300 years ago.

Finally, both world systems and exchange-based models of core and periphery are criticized for their use of static categories that do not adequately reflect complexities and variations on the ground. Although the terms *core* and *periphery* imply that discrete categories exist that are homogeneous within them and heterogeneous between them, in reality it is better to think of a continuum that flows between each level in these geographic models.

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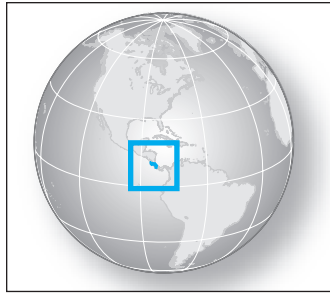
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## Costa Rica

**Map Page** 1136 **Area** 19,729 square mi (51,100 square km) **Population** 3,896,092 **Capital** San Jose **Highest Point** 12,500 ft (3,810 m) **Lowest Point** 0 m **GDP per capita** \$8,300 **Primary Natural Resources** coffee, bananas, agricultural products.



THE REPUBLIC OF Costa Rica, home to almost 3.9 million people, is located in Central America between NICARAGUA and PANAMA with CARIBBEAN SEA and PACIFIC OCEAN coastlines. With a narrow Pacific coastal region, Costa Rica is covered by rugged mountains with peaks over 12,000 ft (3,657 m) high, cutting the country from northwest to southeast. The chain contains several major volcanoes, one of which, Irazu, erupted destructively in the mid-1960s. Costa Rica suffers from occasional hurricanes, earthquakes, and floods in addition to volcanoes.

The coastal plains are low and subject to flooding, as well as being quite hot, humid, and heavily forested. The traditional Costa Rican economy was based upon the agricultural production of these coastal plains, where it is possible to cultivate an abundance of bananas, cocoa, and sugarcane. In contrast to the wet coastal plains, the Nicoya peninsula located in the northwest region of the country is made up of more arid plains. There, extensive cultivation of cash crops like sugarcane is not possible. Instead, these plains have been used by ranchers to raise large herds of cattle and by some farmers who grow grains.

The Central Valley lies between the mountain ranges and volcanoes, where the most productive land is found and coffee is cultivated extensively. Also, under the threat of an eruption, the majority of population lives in the Central Valley, which is the heart of the country and is renowned for its almost constant springlike climate. In addition, Costa Rica has sovereignty over a small island about 300 mi (482 km) off its Pacific Coast, known as Cocos Island, which is celebrated for its natural beauty.

The climate of Costa Rica is tropical and subtropical. The dry season lasts from December to April, while the rainy season lasts from May to November. While it is quite hot and humid along the coastal plains, the Central Valley and the highlands are much more agreeable. In some areas of the highlands, the

temperature varies greatly from that of the coastal areas.

Costa Rica is a democratic republic separated and administered in the form of seven provinces. The executive branch is made up of a president and two vice presidents, a unicameral legislature, and a Supreme Court.

Costa Rica is one of the most stable countries in the Americas; only two very brief periods of instability have taken place since the late 19th century. As a result of the stability, the government has been able to disband the military and to concentrate on economic development.

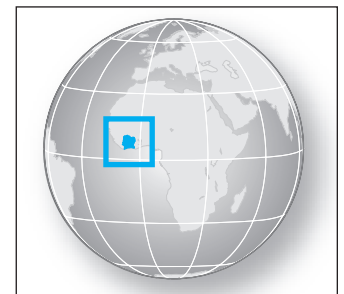
Even though Costa Rica is still mostly dependent upon its agricultural exports, diversification of the economy has succeeded in moving the country away from monocultures. After the success of government initiatives, Costa Rica is now home to expanding ecotourism and technology sectors. Consequently, the standard of living is high, especially relative to neighboring countries, and land ownership in the country is widespread.

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## Côte d'Ivoire

**Map Page** 1113 **Area** 124,501 square mi (322,460 square km) **Population** 17,327,724 **Capital** Yamoussoukro **Highest Point** 5,748 ft (1,752 m) **Lowest Point** 0 m **GDP per capita** \$669 **Primary Natural Resources** petroleum, natural gas, diamonds, manganese.



CÔTE D'IVOIRE (Ivory Coast) is bordered by MALI and BURKINA FASO on the north, by LIBERIA and GUINEA on the west, and by GHANA on the east. The official capital is Yamoussoukro, while the largest city and commercial center of the country is the former capital, Abidjan.

The south consists of a coastal lowland with heavy rainfall, the interior of a densely forested plateau, and the north of upland savannas. There are over 60 ethnic groups in Côte d'Ivoire, the major groups being the Baoule, Beti, Malinke, Senufo, Anyi, and Dan. Of the more than 5 million non-Ivoirian Africans living in Côte d'Ivoire, one-third to one-half are from Burkina Faso, and the rest are from Ghana, Guinea, Mali, NIGERIA, BENIN, SENEGAL, Liberia, and MAURITANIA. The non-African expatriate community includes roughly 130,000 Lebanese and 20,000 French. About 60 percent of the population is Muslim (who live predominantly in the north), 25 percent follow traditional religious beliefs, and 15 percent are Christian (who are mostly concentrated in the south). French is the official language.

Côte d'Ivoire showed remarkable political stability from its independence from France on August 7, 1960, until late 1999. The first president was Félix Houphouët-Boigny, who remained in that position until his death in December 1993. He was succeeded by President Henri Konan Bédié, who was toppled by a bloodless coup by General Robert Guei on December 24, 1999, as falling world market prices for Côte d'Ivoire's primary export crops of cocoa and coffee put pressure on the economy. Elections were scheduled for fall 2000 but were later cancelled by Guei, and this started a period of coups, attempted coups, and civil wars, which ended only in January 2003, when French troops intervened to broker a power-sharing national reconciliation government.

Despite steady industrialization since the 1960s and a high economic growth rate from its independence through the 1970s, the country is still predominantly agricultural, which contributes 29 percent to the gross domestic product and employs approximately 68 percent of the population. Côte d'Ivoire is among the world's largest producers and exporters of coffee, cocoa beans, and palm-kernel oil. Other exports include cotton, bananas, pineapples, rubber, and mahogany and other hardwood timbers. Among the country's industries are the production of foodstuffs, palm oil, petroleum and natural gas (offshore production began in the early 1980s), textiles, construction materials, and fertilizer, and the assembly of motor vehicles and bicycles. Côte d'Ivoire, or Ivory Coast, was named for the supplies of ivory brought to the coast for trade in colonial times.

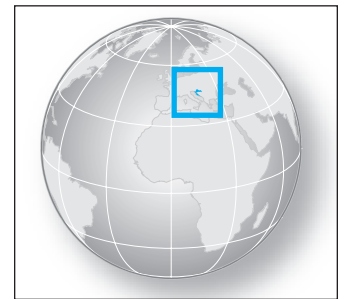
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## Croatia

**Map Page** 1133 **Area** 22,000 square mi (56,542 square km) **Population** 4,422,248 **Capital** Zagreb **Highest Point** Dinara 604 ft (1,830 m) **Lowest Point** 0 m **GDP per capita** \$8,800 **Primary Natural Resources** oil, coal, bauxite, hydropower.



CROATIA IS AT once one of the oldest and newest states in Europe. There has been a Croatian state of some kind, with varying degrees of independence, since the 9th century. Croatia was one of the first to break away from the disintegrating Yugoslav Federation in 1990 and is today one of the more successful economies in the Balkans. Unlike Serbia and many of its other neighbors, Croatia has had closer ties to the West for centuries, as Catholics rather than Orthodox, and as subjects of Western rulers rather than Turkish sultans like their neighbors to the south and east. Today, Catholicism is regaining importance in Croatian national identity.

The physical shape of Croatia is reminiscent of a croissant, the symbol of defiance to Turkish invaders in the 17th century: The inland (or Pannonian) region consists of Croatia proper (with the capital, Zagreb) and Slavonia to the east. The coastal region consists of Istria and Dalmatia, extending along the ADRIATIC SEA coast for nearly 1,200 mi (2,000 km). The coast is dominated by inlets and over a thousand islands, creating a coastline of 3,618 mi (5,835 km). Only 69 of the islands are inhabited, the largest being Krk, Brac, and Cres. The interior consists of flat plains along the Hungarian border and the river valleys of the Drava and Sava (tributaries of the DANUBE to the east), and low mountains. The climate here is continental, differing sharply from the Mediterranean climate along the

Adriatic. High mountains divide these two regions, extensions of the Julian and Dinaric Alps that run north to south from Istria to Montenegro. Croatia borders a number of countries, mostly former members of Yugoslavia: SLOVENIA to the northwest, SERBIA AND MONTENEGRO to the east and south, and BOSNIA AND HERZEGOVINA to the east. HUNGARY lies across the Drava to the north.

### EARLY HISTORY

Much of Croatia's history is dominated by Hungary, first in a personal union between the Croatian and Hungarian royal families dating from 1102, followed by outright incorporation within the Hungarian kingdom from the 18th century. Croatia formed the highly militarized frontier between the Hapsburg and Ottoman dominions for several centuries. The coastal provinces of Dalmatia and Istria had a different history, however, falling under the administration of the Venetian Republic from the early 15th century. The famous maritime republics of Ragusa and Spalato were founded by Venetians and today (as Dubrovnik and Split) remain two of the most famous tourist destinations in the Mediterranean. At the end of World War I, Croatia and Dalmatia joined together as a component state within the new kingdom of the Serbs, Croats, and Slovenes, later renamed Yugoslavia.

Today's Croatian economy is split evenly between agriculture and industry. The best farmland is in the far northeast, where corn, wheat, and fruits are grown. Timber is also a significant resource in this area. Industry is mostly light, concentrating on chemicals and plastics, plus some extractive products such as coal, petroleum, and bauxite. Privatization delays and unemployment are Croatia's biggest issues today, as it works toward full membership in the EUROPEAN UNION. Tourism is on the rise as the region becomes more secure and is currently Croatia's biggest source of revenue. The Dalmatian coast is sunny and warm year-round, and is called the Riviera of the Adriatic. Dubrovnik was heavily damaged during warfare in the early 1990s but has been rebuilt under its status as a United Nations World Cultural Heritage Site.

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## Cuba

**Map Page** 1137 **Area** 68,885 square mi (110,860 square km) **Population** 11,263,429 **Capital** Havana **Highest Point** 6,578 ft (2,005 m) **Lowest Point** 0 m **GDP per capita** \$2,700 **Primary Natural Resources** sugar, tobacco, citrus, coffee, rice.



CUBA, THE 15th largest island in world, is part of the West Indies in the CARIBBEAN SEA. This island, which experiences a subtropical climate and a wet summer season between May and October, is composed of fertile ground where tobacco, sugarcane, and coffee are grown and where cattle graze. Twenty-five percent of the island is covered by the Oriental, Central, and Occidental mountain ranges.

More than 6,000 plant species are spread across Cuba. The royal palm is the most noticeable, and supposedly 20 million palms exist across the island. Cork palm can also be found on the island, as well as the palma barrigona, the ceiba, and the mariposa. The southern coast supports swamps with fish and birds.

Reptiles are the most abundant fauna. Crocodiles, iguanas, salamanders, lizards, and turtles, as well as a mixture of nonpoisonous snakes, are present throughout the country. The *jutia* (a tree rat) is the largest land mammal on the island. And the world's smallest bird, the bee hummingbird, originates from Cuba.

Modern-day history of Cuba can be traced back to November 27, 1492, when Christopher Columbus landed on the island. For the next 300 years, Spain had control over the small island. During the 16th century, the indigenous Tainos were virtually obliterated from the island. Subjected to a life of labor under the Spanish *encomienda* system, these indigenous people were forced to mine for silver and gold and to work the many plantations spread across the island.

Overall, the Spanish found a limited amount of silver and gold on the island. As the years passed, it was obvious that Cuba would have to serve other purposes for the Spanish administration. The island became a stopover for ships carrying goods from the Americas to Europe. In 1607, Havana was created as the Cuban capital. The forests across the island were cut down to make room for livestock, tobacco, and sugar for European sale. However, after the defeat of the Spanish Armada in 1587, Spain's New World colonies, such as

Cuba, suffered from a lack of central control. The unregulated West African slave trade flourished and pirates appeared in Cuban ports.

In 1762, 200 English warships with 20,000 troops appeared outside of Havana. After 44 days, Havana fell to the English, but within a year, the British traded their new possession back to SPAIN for the land of FLORIDA. The new king of Spain, Charles III, began to actively encourage free trade, and the Cuban economy prospered. By 1820, Cuba held the distinction of being the world's largest sugar producer. By 1835, all the New World colonies of Spain had received independence, except for PUERTO RICO and Cuba. Cuban revolutionaries began to form protests. In 1868, slavery was finally abolished and an overall rebellion for independence rose throughout the land. Ten years of war lasted and around 200,000 people perished in the fighting; some 100,000 fled the island. The Pact of Zanjón was signed in 1878, which ultimately granted all the rebels amnesty. However, independence was still not granted.

Cuban exiles in the UNITED STATES, including the poet José Martí, began plans for the next wave of rebellion. In 1895, they landed on eastern Cuba, and Martí was fatally shot. The rebels continued to fight, and in return, the Spanish government executed public figures and threatened civilians. Cuba eventually agreed to a home rule government for the Cubans, but the Cuban citizens wanted full independence.

In 1898, the U.S. warship *Maine*, anchored in the harbor in Havana, exploded. Although the reason for the explosion was unknown, American newspaper reports blamed the Spanish. American troops were dispatched to the island and the Spanish-American War began.

After various victorious American battles, including the Battle of San Juan Hill, a peace treaty was signed in December 1898. Although the Cubans were now independent of Spain, the U.S. influence on Cuba began. In 1902, the United States granted Cuba full independence but, under the Platt Amendment, reserved the legal right to intervene militarily if Cuba's independence was threatened. The Guantánamo Bay naval base was also leased by the United States, and is still currently occupied by the U.S. military.

By the 1920s, over two-thirds of Cuba's farmland was owned by American companies. Into the 1950s, Cuba was ruled by a number of military and political figures. During the early years of the Great Depression, President Gerardo Machado y Morales violently ended civil unrest throughout the country. He was overthrown in a coup, and Fulgencio Batista gained power,

which would last for more than 20 years. Throughout this period, Cuba suffered economically, and active resistance groups were formed.

Fidel Castro emerged as a very influential rebel leader. In 1953, he led an attack on the Moncada barracks in Santiago. More than 100 died, and Castro faced a public trial. He was jailed but given an early release. He was exiled to Mexico, and from there organized the 26th of July Movement. In December 1956, Castro and his group landed on the eastern part of the island. For three years, guerrilla warfare spread throughout the island. On January 1, 1959, Batista was overthrown and fled to the DOMINICAN REPUBLIC.

Castro became the prime minister of the country, and overhauled the economy. He nationalized much of the land and American-owned petroleum facilities. The United States in return cut sugar imports, which debilitated the economy. With a deteriorating economic situation, Castro turned to the Soviet Union for aid. Sugar trade thus developed between Cuba and the Soviets.

### BAY OF PIGS

In 1961, the U.S. CIA organized an invasion in the Bay of Pigs. Fourteen hundred CIA-trained Cuban exiles attacked Castro forces but were quickly captured. Castro declared that Cuba was to be a socialist state. The Soviet Union sent food, supplies, and nuclear missiles to the island that was only 90 miles off the coast of superpower rival, the United States. After an extremely tense nuclear standoff in 1962 between Cuba, the United States, and the Soviet Union, the missiles were returned to the Soviets.

For the next three decades, Cuba became a leading military and political force in the Third World, but its economy fell into major disrepair. In 1989, after the collapse of communism in Eastern Europe and the decline of the Soviet Union, RUSSIA withdrew its aid. In 1991, economic reforms began in the country. Cuban citizens were allowed to be self-employed and farmers' markets were opened. Slowly, the Cuban economy grew. Sensing that Castro's power base was declining, the United States passed the Helms-Burton Act, which imposed harsher embargo conditions on Cuba. In 2004, Castro's hold on Cuba was still strong and the country remained one of the last socialist states in the world.

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## cultural geography

CULTURAL GEOGRAPHY IS a subdiscipline of HUMAN GEOGRAPHY. The founding father of cultural geography in North America is Carl Ortwin SAUER, and most of the research in cultural geography from the 1920s to the beginning of the 1980s was carried out by cultural geographers walking in the footsteps of Sauer and the so-called Berkeley School. In this tradition, cultural geography is concerned with material facets of culture. On the agenda of the Berkeley School were cultural influences on, and shaping forces of, the transformation of landscape and the natural environment. In short, the role that culture plays as an agent of these changes.

In this respect, the American tradition of cultural geography of the 20th century was a dominating and highly influential one. Since the end of the 1970s, however, cultural geography in the anglophone scientific community took on a different face. Drawing heavily on British cultural studies, focusing on interpretative and empirical methods, and refurbishing social theory, cultural geographers of that time developed the so-called new cultural geography. The mere amount of studies and research that has been carried out until today under the banner of this new cultural geography, and also the colorful, true-to-life, and rich array of topics hosted by the discipline, made new cultural geography probably the most successful subdiscipline of geography throughout the last 30 years. This boom, the beginnings of which are often referred to as the cultural turn in geography, has changed the discipline fundamentally. Nevertheless, recently there has been a vivid, critical discussion about the shortcomings of these new cultural geographies, which is revolving around the topics of the dangers of a holistic culturalist approach and the dematerialization and the (missing) political potential of the new cultural geography.

### THE NEW CULTURAL GEOGRAPHY

Turning away from environmental determinism and the regional tradition of the geography of his time, but drawing nevertheless on some aspects of both tradi-

tions, Sauer developed his own concept of cultural geography. Driven by an interest in historical processes and sequences and their influence on the natural environment, he was influenced to a certain degree by the German geographers Eduard Hahn and Alfred Hettner and the anthropogeographic tradition associated with Friedrich Ratzel, who was one of the first geographers to introduce the term *Culturgeographie* and an accompanying concept of cultural geography (as early as 1880). An important proof of this influence is the adoption of the concept of *Landschaft*, which Sauer took from German geography and then transformed it into his landscape concept, a central and meanwhile well-known feature of Sauerian geography.

Moreover, Sauer was influenced by American historical anthropology of his time. These and other influences led to the specific Sauerian strain of cultural geography where culture was the agent, space the medium, and the cultural landscape the result of human activities. According to Sauer, through time, culture influences and transforms space. Culture was thus regarded as the reason for the origins of certain landscapes.

Cultural geography conducted by Sauer and his followers of the Berkeley School circled around the whole array of human interventions and consequent transformations of the natural environment: domestication of plants and animals, the DIFFUSION of these domesticates, cultivation methods, and other artifacts of material culture and cultural practices, and their consequences for the transformation of the natural environment. These topics were studied from an explicitly ecological and rural, antiurban and perhaps antimodern perspective with a strong focus on folk and prehistoric cultures and native peoples. Geographical inquiry via observation, thus fieldwork and a critically distanced stance against theory and theorization of culture, was foundational in Sauerian cultural geography.

From the end of the 1970s on, however, Sauer's concept of culture was attacked by a new generation of cultural geographers. Representatives of this new school of thought (for example, Peter Jackson, James Duncan, and Denis Cosgrove are important representatives of the first generation of new cultural geographers) fiercely criticized Sauer and the Berkeley School. The traditional cultural geography was blamed for regarding culture as a fixed reality and, furthermore, for considering culture to be static and a superorganic entity. The critique went so far as to state that culture lowers individuals and human beings to the level of automates or Pavlovian dogs, who are passively forced



*The spread and use of the English language is one example of cultural geography. Linguistics and literary studies, communication theory, and the recognition of the construction of meaning through language are part of the academic study.*

into the dictatorship of culture. Drawing to a high degree on the findings of linguistic theory, and showing close affinity to critical social theory and the newly emerging field of Marxist-influenced British cultural studies, the new cultural geography developed a revised transdisciplinary concept of culture.

Arguing with constructivism and post-structuralism, culture was considered to have no ontological base, that is, to have no fixed reality. Instead, culture was considered to be the context for human action and interaction. Culture was seen as a set of relations that influence and, in part, determine how we live our lives. Multifaceted meanings and interpretations—in short, the plurality of cultures and heterogeneity of cultural processes—was emphasized.

Linguistics and literary studies, communication theory, and the recognition of the construction of meaning through language set the theoretical stage on which all material and nonmaterial facets of culture and also landscape were considered as “texts.” By way

of semiotic analysis, real and symbolic landscapes were interpreted in terms of symbolic content or the role for symbolic exchange. Different, multiple ways of seeing, experiencing and ascribing meaning to space were as much on the agenda of new cultural geography as was the role that cultural processes play in the construction of identities.

### COMPLEX SHIFTS

Furthermore, space theories fueled the new cultural geography’s view that landscapes, places, and spaces are under permanent social construction and transformation. These were the complex shifts in cultural geographic thinking after the cultural turn. With it, the ways of doing cultural geography had to be equally revised. As a consequence, the methodological focus of cultural geography changed, and it has become an increasingly empirical and interpretative subdiscipline drawing a great deal on discourse analyses and qualitative methods.

This shift in cultural geography was also fueled by questions for the social and political relevance of the subdiscipline. Matters of social justice, the concern with issues regarding ethnic minorities, subcultures, and “the other,” challenging fixed and essential notions of race or nation and gender and, furthermore, a concern with postcolonial and power-resistance issues were on the agenda.

### CULTURE WARS

The so-called culture wars on questions of dominance or on issues of the power of representation, as well as struggles over the power of the production of meaning, have been of special interest for cultural geographers. Space, culture, and power were the three points on which the canopy of new cultural geography was unfolded. To the same degree, cultural geography has been recognizing the importance of contemporary, urban, and popular culture (both production and reception), the practice of the everyday life, and the subjective experience and perception of space.

Moreover, there has been a growing concern for the workings of mass media on space or for the construction of space, and on various kinds of representations in television shows, film, literature, or music. From all this, it can be easily seen that a huge range of topics and issues entered the stage of cultural geographic research: film, books, food, music, advertising, religion, heritage, tourism, transnational networks and cultural transformations, sexuality, and so on have become the subjects of geographers' efforts to research matters of culture and the production of space.

### CRITIQUE OF NEW CULTURAL GEOGRAPHY

In recent years, however, there has been a considerable amount of critique of some aspects of how the new cultural geography has been practiced. This critique, put up for discussion by critical geographers with affiliations to Marxist and neo-Marxist thought (for example, Don Mitchell and Clive Barnett), basically considered new cultural geography as a victim of its own success. The critique is highlighting the dangers of a hegemony of the cultural, of the notion that “culture is everything,” and that in the doctrine of culturalism, nothing exists outside of cultural meaning. This culturalism, it is argued, weakens the political power of cultural geography.

A focus on everything that is in one way or another cultural is accompanied by a drift away from the study of exploitative economic systems of production. It is stated that although the focus on cultural politics is ex-

plicitly favored by new cultural geography, it is now in danger of being drowned by the mere number of all kinds of studies in new cultural geography. Often, it is argued, these studies are nothing more than a mere descriptive cataloguing of anything that is cultural, without explaining the complexity and multilayered characteristics of culture or cultural differences.

The accusation of arbitrariness of the themes and ways of doing new cultural geography has also been discussed. Moreover, it has been stated that a fast codification and a new orthodoxy of “the cultural” by new cultural geography has pushed away the radical character of the subdiscipline. Critical voices amplified the warning echo of a renewed version of culture as the superorganic entity of the Sauer era, which could be heard in the noise made through and around the new cultural geography.

The questions from these critical voices are connected to a plea for a thorough examination of the inner workings of culture—that is, of what culture is—and of the question about who reifies this culture—that is, what are the power relations, who oppresses, and who dominates and exploits in the realm connected to culture and its (re-)production?

Another point of critique regards the dematerialization of cultural research, that is, the turn away from the real needs and topics of the everyday toward the treating and reading of virtually everything as a more or less abstract cultural “text.” It is suggested that this might blunt the cutting political edge of cultural geography that is so urgently needed for the concrete improvement of the everyday life of people.

Nevertheless, as substantial as these critiques may be in showing actual and potential pitfalls of contemporary cultural geography, they can also be regarded as very valuable contributions for refining our understanding of culture and another step toward the reconsideration and further development of cultural geography.

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## cyclones

CYCLONES ARE HAZARDOUS weather conditions distinguished by extreme blasts of wind moving in a circular pattern. Cyclones generally appear over tropical waters; however, some are able to reach land, where they inflict significant damage on buildings and communities.

Cyclones can be placed into categories such as hurricane (Western Hemisphere) and typhoon (Eastern Hemisphere). The categorization assigned to a cyclone is dependent upon where it originated. Wind speeds in cyclones can surpass 100 mi per hour (160 km per hour). Tropical cyclones with milder conditions are known as tropical storms.

Cyclones build over tropical seas. Heat gives cyclones their energy. Consequently, the ocean over which a cyclone forms must be warm. Other conditions required for a cyclone include a rapidly cooling atmosphere, a minimum of 300 mi (500 km) distance from the equator, and a slow vertical wind not exceeding 23 mi per hour (37 km per hour). This vertical wind is the product of differences between winds in the lower and upper portions of the atmosphere. The major contributor to the formation of a cyclone is a disturbance in the form of a thunderstorm or group of showers.

When all of these factors come together, conditions are right for a tropical cyclone. However, cyclones are spontaneous; a minute variation in one variable can be the difference between a hurricane and a thunderstorm.

Known as the “eye,” the circular area in the center of a cyclone has an environment quite different from the area it surrounds. Calmness and a light breeze characterize the eye. Temperatures and air pressure are normally higher, and the sky is generally very clear.

Strong cyclones can cause damage ranging from crop destruction to the total devastation of buildings, depending on the severity of the cyclone. Cyclones become most dangerous as they hit land and spawn tornadoes, which are formed when tropical cyclones begin to lose their power. The major variation between trop-

ical cyclones and tornadoes is their size. While the diameter of a tornado is measured in meters, the diameter of a tropical cyclone is measured in kilometers. One of the most destructive cyclone-spawned tornadoes in the United States caused around \$100 million worth of damage to the Austin, TEXAS, area in 1980.

Besides property damage, cyclones (and the ensuing tornadoes) cause death. Objects lifted from the path of the extreme wind are flung about as high-speed projectiles. In 1964, 22 people were killed by a tornado that hit the LOS ANGELES area in CALIFORNIA.

Meteorologists have come a long way in the forecasting of tropical cyclones. In their forecasts, they gather information from the global numerical weather prediction model, which is also used by many meteorological centers, to aid them in producing accurate warnings. The World Meteorological Organization has created Regional Specialized Meteorological Centers (RSMCs) that issue warnings to nations, which then issue warnings to the public.

Warnings are issued when a cyclone is likely to affect communities within 24 to 48 hours. The warnings include a forecast that predicts which communities may be affected, severity, movement, etc. depending on how severe a cyclone is, residents may be asked to take certain precautions or even evacuate the possible affected area.

### CATEGORY WARNINGS

Cyclones are divided into five categories determined by wind speeds, with category 5 being the worst cyclone of all. A category 1 warning is issued when wind gusts are less than 77 mi per hour (125 km per hour). A category 2 warning is issued when wind gusts are from 77 to 105 mi per hour (125 to 169 km per hour). When winds are from 106 to 139 mi per hour (170 to 224 km per hour), a category 3 warning is issued. Category 4 is when winds reach speeds from 140 to 173 mi per hour (225 to 279 km per hour). The most destructive of all is a category 5 cyclone with winds faster than 174 mi per hour (280 km per hour).

In order to avoid confusion when tracking the development of these storms, cyclones are regularly named. The naming of cyclones began during World War II when meteorologists in the U.S. armed forces unofficially named the cyclones giving them female names. During the early 1950s, tropical cyclones that formed in the North ATLANTIC OCEAN were named from the phonetic alphabet. In 1979 the U.S. National Weather Service used both male and female names. When an exceptional cyclone occurs, its name is taken



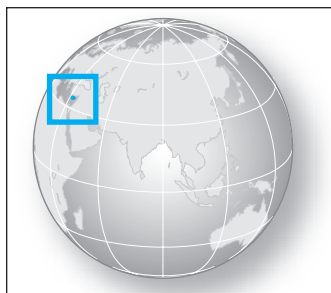
out of use to avoid confusion. More than one cyclone can occur at the same time, and if names are given, there is less confusion about which cyclone is being described. Cyclones can range from simple tropical storms to devastating hurricanes spinning at furious speeds. Their effects can be disastrous and long-lasting.

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## Cyprus

**Map Page** 1121 **Area** 3,604 square mi (9,250 square km)  
**Population** 771,657 **Capital** Nicosia **Highest Point** 6,407 ft (1,951 m) **Lowest Point** 0 m  
**GDP per capita** \$15,000 (Greek) \$6,000 (Turkish)  
**Primary Natural Resources** copper, pyrites, asbestos.



CYPRUS IS AN island in the eastern MEDITERRANEAN SEA, 70 mi (113 km) south of TURKEY. For thousands of years, its civilization has been at the crossroads between Europe, Asia, and Africa. Today, Cypriots continue to play a role as a bridge between cultures, because of their island's proximity to the MIDDLE EAST, its cultural connections to GREECE, and its political status as one of the newest member states of the EUROPEAN UNION (EU).

Cyprus is politically divided, however, between the Greek-speaking majority in the southern part of the island and the self-proclaimed Turkish Republic of Northern Cyprus. This division has been in place since 1974 and remains unresolved despite pressure from the EU and the United Nations (UN).

The name *Cyprus* (Kypros in Greek) either derives from, or gives its name to one of the chief natural resources on the island: copper. This metal has been

mined from the Troödos range since prehistoric times. The Troödos dominate the central and southern part of the island. The rest of Cyprus consists of the northern Kyrenia range, or Girne in Turkish, and the plain between the two ranges, the Mesaoria. There are also scattered plains along the southern coast. The Kyrenia is a narrow limestone ridge that extends far to the northeast of the mainland to form the Karpaz Peninsula. The Mesaoria is semiarid, sheltered from rains by the northern mountains. Wheat and barley are grown there, but require IRRIGATION for agriculture.

Significant rivers rise from the Troödos Mountains but are mostly dry in the summer. Severe deforestation has contributed to the island's water problem, particularly around the city of Nicosia, which occupies the central part of the Mesaoria. Nearly 200,000 people live in this city, called Lefkosa by Turkish Cypriots, who claim the northern part of the city as their capital. Other cities include Limassol, Larnaca, Famagusta, Paphos, and the ruined city of Salamis.

The diversity of building styles in these cities reflects the varieties of outside influences that have dominated Cypriot history since the second millennium B.C.E. Cyprus was a Roman then a Byzantine province for 1,000 years until it was taken over by Crusaders in the 12th century, notably the de Lusignan family, who set up a Catholic kingdom in opposition to the majority Orthodox population.

Venetian merchants, eager to secure their monopoly on trade in the eastern Mediterranean, purchased the island in 1489 but lost it to the Ottoman Turks in 1570. The Turks ruled Cyprus through a restored traditional Orthodox hierarchy, reinforcing the position of the church and the Greek language in Cypriot politics and culture. In 1878, control of the island was ceded to the British, eager to safeguard their shipping lanes to the Suez Canal. Great Britain formally annexed Cyprus in 1914. Independence was granted in 1960, but the island remains a member of the British Commonwealth, and the UNITED KINGDOM retains sovereignty over two military bases on the south and southeast coasts.

As early as the 1820s, Greek Cypriots expressed a strong desire for political union, or *enosis*, with the rest of Greece. It is this desire that has been at the root of the tension between Greeks and Turks on Cyprus ever since. The original 1960 constitution allowed for minority representation in government, but these stipulations were dropped in 1963. In 1974, a coup backed by Greece prompted military intervention from Turkey, and the country was divided into the southern and

northern sections of today, divided by the so-called Green Line, patrolled by UN troops. In 1983 the Turkish area—roughly a third of the island declared itself to be the Turkish Republic of Northern Cyprus (TRNC), but it is recognized only by Turkey.

UN-led direct talks began in January 2002, and several proposals have been brought forward. A referendum on a plan set forth by UN Secretary-General Kofi Annan in April 2004 was approved by Turkish Cypriots but strongly rejected by the Greek population. It had been hoped that a settlement could be reached by the time of Cyprus's entry into the EU in May 2004. Many EU members were impressed, however, with Turkish willingness to settle their differences, which may in the long run lead to increased financial aid to the impoverished north.

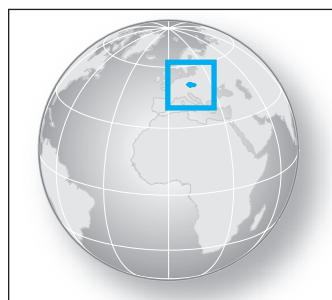
The economy of Cyprus was severely disrupted by the division of 1974 but has recovered in the south, mostly through a huge increase in tourism. Tourism and other service industries today contribute 76 percent of the gross domestic product and employ 70 percent of the labor force. Millions of tourists per year come for Cyprus's clean waters and relatively undeveloped beaches. Southern Cyprus has also become a center for international business and offshore banking, due to its proximity to the Middle East, and its educated, English-speaking population. The north has had less of a recovery and continues to rely heavily on financial support from Turkey.

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## Czech Republic

**Map Page** 1133 **Area** 30,450 square mi (78,866 square km) **Population** 10,249,216 **Capital** Prague **Highest Point** 5,256 ft (1,602 m) **Lowest Point** 377 ft (115 m) **GDP per capita** \$15,300 **Primary Natural Resources** graphite, coal, timber.



THE CZECH REPUBLIC consists of the two historic regions of Bohemia and Moravia. The Czech Republic borders SLOVAKIA to the southeast, POLAND to the north and northeast, GERMANY to the north and west, and AUSTRIA to the south. The Czech Republic is a parliamentary democracy with a parliament as its legislature. The prime minister serves as the head of government, and the president serves as head of state. Prague, Brno, Ostrava, and Plzen are major cities of the country.

Bohemia is a PLATEAU surrounded by the Ore or Erzgebirge Mountains and the Sudetes Mountains on the north and drained by the Vltava. Moravia is a lowland region that is drained by the Morava River, which flows into the DANUBE. The climate in the Czech Republic varies with the region from 30 degrees F (-1 degree C) in January to 67 degrees F (19.4 degrees C) in July. In higher elevations, the climate is colder and receives more rain.

The region comprising the Czech Republic was first settled by two Celtic groups, the Boii, from which the region Bohemia gets its name, and the Cotini. By the 5th century, Slavs from the east settled in the region and formed the kingdom of Bohemia in the 10th century. In the 15th century, Jan Hus led a movement against the Roman Catholic Church, which presaged the Protestant Reformation a century later. In 1526, the Habsburg dynasty from Austria gained control of the Bohemian throne.

The Thirty Years' War began in Prague when the Czechs rebelled against Habsburg rule in 1618. By 1620, Czech forces were defeated by the Habsburg forces, placing Bohemia under Austrian rule for 300 years. The convulsions of World War I led Czech leaders to push for full independence. In 1918, Czechoslovakia, with a diverse population of Czechs, Slovaks, Germans, and Ruthenians, emerged as a successor state to the Austro-Hungarian Empire. The First Republic of Czechoslovakia, led by Thomáš Masaryk, was organized as a Western democracy, which was one of the most stable and prosperous countries of Central Europe during the interwar period. During the 1930s, as Europe witnessed the rise of fascism, Czechoslovakia fell prey to Nazi ambitions.

In September 1938, at the Munich Conference, Britain and FRANCE gave the German-populated Sudetenland in northern Czechoslovakia to Adolf Hitler, who reorganized the country into the Second Republic in 1939 as a Nazi puppet state, granting autonomy to Slovakia.

Liberated by the Soviets in 1945, Czechoslovakia reemerged as an independent nation. By 1948, how-

ever, the communists, with the backing of the Soviet Union, took control of the government, creating the Third Republic. All prewar political parties were banned, and anticommunists were convicted in show trials.

The communists nationalized all industry, collectivized all agriculture, and restricted all churches in the years immediately following World War II. In 1968, President Alexander Dubcek proposed liberal reforms to the political and economic system, which included distancing Czechoslovakia from the Soviet Union. This “socialism with a human face” was put down by intervention by the Soviet Union and members of the Warsaw Pact, and Czechoslovakia was placed in a tighter orbit with Moscow. By 1989, pressures for change throughout Eastern and Central Europe led to the Velvet Revolution, which overthrew communist rule in Czechoslovakia. Dissident Vaclav Hável became president of Czechoslovakia and he oversaw its transition to democracy, with Vaclav Klaus as prime minister to oversee economic reform. The Velvet Revolution raised the age-old question of the relationship between the Czechs and the Slovaks, and by 1993 came the Velvet Divorce, which was the peaceful split of Czechoslovakia into the Czech Republic and SLOVAKIA. Since then,

the Czech Republic has made strides to integrate into the European economy. It has been one of the few Eastern and Central European states to make a successful transition to a free market economy, albeit with some difficulties in the rising inequality of wealth. The Czech Republic joined the NORTH ATLANTIC TREATY ORGANIZATION in 1999 and the EUROPEAN UNION in 2004.

Czechs make up the majority of the population of the Czech Republic. Sizable minorities of Slovaks and Roma (Gypsies) also reside in the Czech Republic. A significant German population existed in the Sudetenland, but many were expelled after World War II. The Czech Republic has had an industrialized economy since the days of the Austro-Hungarian Empire. Its chief exports are consumer goods, and machinery. Its chief industries are machinery, automobiles, textiles, and glass. Its imports are consumer goods and fuel.

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## Damascus

DAMASCUS (in Arabic, “Dimashq”) is the capital and chief city of SYRIA, with a population of 1.7 million people (2002). The ancient city is also known in Arabic as “as-Sham” meaning “the Northern,” indicating its geographical position north of the traditional Arab homelands. Damascus is situated in the Ghutah Oasis on a plateau 2,263 ft (690 m) above sea level in southwestern Syria. The city is bisected by the Barada River, which separates the old city to the south from the newer, more modern city to the north. It lies just northeast of Mount Hermon (7,164 ft or 2,184 m), the highest point in the Anti-Lebanon Mountains that form part of Syria’s eastern border with neighboring LEBANON. To the east of the city lies the DESERT.

Damascus is only a two-hour drive from the MEDITERRANEAN coast, which is just beyond the Anti-Lebanon and Lebanon mountains to the east. Annual rainfall in the area ranges between 6 in (15 cm) and 7.87 in (20 cm), falling mainly between November and February. Although temperatures in the summer can exceed 104 degrees F (40 degrees C), the summer average is around 80.5 degrees F (27 degrees C) at the most. Winters are generally cold, averaging 41 degrees F (5 degrees C).

Damascus has been inhabited since prehistoric times and is considered by some to be the oldest con-

tinuously occupied city in the world. The first mention of Damascus is in Egyptian records, when the Pharaoh Thutmosis III conquered the city in the 15th century B.C.E. In 333 B.C.E., Damascus was conquered by one of Alexander’s lieutenants, who took it from the Persians. From 661 to 750 C.E., Damascus was the center of Islam and capital of the Great Omayyad Empire that stretched from Spain to India. In 1260 the city fell to the Mongols under Hulagu Khan, then fell again to the Mamluks following the Mongol withdrawal. In 1516, the city was captured by the Ottoman Sultan Salim I and remained part of the Ottoman Empire for the next four centuries. At the end of World War II, the city was freed from Ottoman control by an Arab contingent under the command of the British. Damascus became the capital of an independent Syria (from FRANCE) in 1941, although it did not officially take effect until 1946.

Damascus is made up of a sizeable old city, divided into the market area, the Muslim area, the Christian area and the Jewish area. The greatest part of the city, including the rectangular ancient city, is on the south bank of the Barada River, while the newer more modern suburbs lie to the north. Damascus has more than 200 mosques, but only 70 are still in use today. Of these, the Umayyad or Grand Mosque is the most famous, located just east of the Citadel and north of the Azem Palace in the old city. Damascus is famous for its

bazaars—streets lined with shops, stalls, and cafes. One such bazaar called “Street Straight” (in contrast to the typically narrow, crooked layout) is even mentioned in the Bible in connection with St. Paul’s conversion to Christianity.

Damascus has long been an important commercial center. In former times it was famous for dried fruit, wine, wool, linens, silks, and damask, a type of patterned fabric, named for the silk fabrics woven in Damascus. The city was also notable for the manufacture of damascened steel, the exceptionally hard and resilient steel used in making sword blades. Today the city is the trading center for figs, almonds, and other fruit produced in the surrounding region. Industries in Damascus include handicrafts, such as the weaving of silk cloth and the making of leather goods, filigreed gold and silver objects, and inlaid wooden, copper, and brass articles. Among the city’s other manufactures are processed textiles, metalware, refined sugar, glass, furniture, cement, leather goods, preserves, confections, and matches.

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## Danube River

THE DANUBE RIVER IS the longest river in western Europe, surpassed in Europe as a whole only by the VOLGA in RUSSIA. Fourteen countries are drained by its watershed, covering over 312,000 square mi (800,000 square km): GERMANY, AUSTRIA (and small parts of eastern SWITZERLAND), the CZECH REPUBLIC, SLOVAKIA, HUNGARY (and a small corner of southwest UKRAINE), SLOVENIA, CROATIA, BOSNIA AND HERZEGOVINA, SERBIA AND MONTENEGRO, BULGARIA, ROMANIA, and MOLDOVA. The river travels 1,760 mi (2,850 km) from its source in Germany’s Black Forest to its large delta on the BLACK SEA, passing through some of the most beautiful and historic cities in Europe, including Vienna, Bu-

dapest, and Belgrade. The most famous stretch of the river, between Vienna and Budapest, has been immortalized numerous times in paintings, poetry, and music, notably Johann Strauss, Jr.’s “An der schönen, blauen Donau” (“On the Beautiful, Blue Danube”).

The Greeks called the Danube the “Ister,” the “Greatest of Rivers,” and for many centuries it was the border between the civilized Greco-Roman world and the Germanic barbarians to the north. Many centuries later, it formed the center, not the boundary, of the multiethnic Habsburg Empire, centered on Vienna and Budapest, which was torn apart by the peace settlements after World War I and by the Iron Curtain of the post-World War II era. There remains, however, some desire to reunite much of the region into a Danubian economic confederation, reflecting the reality that although language and culture divide Austrians, Hungarians, Serbs, Bulgarians and Romanians, the river unites them through commerce and industry.

The Danube starts in southwestern Germany, where it is called the Donau. Two small rivers, the Brege and the Brigach, come together at Donaueschingen, a town in the Black Forest. Its springs lie only a few meters from streams that flow westward into the Rhine watershed, thus ending up in the North Sea rather than the Black Sea, nearly 1,000 miles (3,000 km) apart. In fact, porous rocks in this area result in much of the water of the upper Danube actually seeping through the rocks to join the Rhine watershed, which has a lower elevation.

The river is too small for navigation as it winds through the Swabian Alps, passing castles and monasteries, and the ancient German cities of Ulm and Regensburg, once the capital of the Holy Roman Empire. At Passau, on the border with Austria, the Danube is joined by its first large tributary, the Inn. This was historically the western terminus of commercial river traffic, especially for grain coming to Central Europe from the plains of Hungary, but also for coal and iron ore from as far away as Russia.

In Upper Austria, the Danube passes some of the most famous baroque buildings in Europe, especially Melk, the Versailles of monasteries, perched on a hill above the river valley. Finally the river broadens into the famously smooth (and generally muddy brown, not blue) Danube as it passes by the capital cities of Vienna, Bratislava, and Budapest before turning south to cross the broad Hungarian Plain. This plain, the breadbasket of Central Europe, was also the site of many important battles, from the defeat and forced settling of the Hungarian people by Emperor Otto I in 955, to the



*The longest river in western Europe, the Danube passes through several capital cities, including Budapest, Bratislava, and Vienna. The river's watershed drains some 14 countries, from Germany to Bulgaria.*

destruction of the native Hungarian kingdom by the Turks at Mohács in 1526, and the defeat of Turkish forces after the siege of Vienna in 1683, finally halting their progress toward Central Europe.

South of this plain, the river again enters mountainous regions, guarded by the fortress city of Belgrade. In these middle reaches, the river (called Duna in Hungarian and Dunav in Serbian) receives its largest tributaries, the Tisza, which drains the eastern Hungarian Plain, the historic region of Transylvania (northwestern Romania), and southwestern Ukraine; and the Drava and Sava, which receive most of the waters of Slovenia, Croatia and Bosnia and Herzegovina.

### IRON GATES

In Serbia, the river's course meanders as it cuts passages through the confluence of the easternmost ALPS and the Carpathian Mountains. At its narrowest, the river passes through the Iron Gates, the site of one of Europe's largest hydroelectric projects, the Djerdap, which provides almost half of the electricity consumed by Serbia and Romania. The other major hydroelectric project on the Danube is the Gabčíkovo dam, in Slovakia. This dam, built in 1992, created a huge 11-mi (24

km) reservoir, with serious ecological consequences downstream in Hungary. Originally a partner in the project, Hungary withdrew with the fall of communism, causing severe tensions with the Slovak government. Other man-made projects along the river's course include the Rhein-Main-Donau Kanal, built in 1992, which links the North Sea to the Black Sea, though it is still mostly underused.

The lower course of the Danube forms the border between Bulgaria and Romania, through a broad drainage basin between the Carpathian and Balkan mountain ranges to the north and south. The river ends in a vast DELTA in Romania, the largest in Europe, with an area of 1,700 square mi (4,345 square km). Part of the delta also lies in the Ukraine. Flow at the mouth of the Danube averages 229,450 cubic ft (6,500 cubic m) per second, but has been recorded at 10 times this volume during high flooding. Some 122 million tons of sediment is discharged each year, creating one of the most extensive and fertile wetlands on Earth. Most of this is now protected by the Danube Delta Biosphere Reserve, 1.7 million acres (679,222 hectares) of marshes and lakes, declared a UNESCO World Heritage site in 1991.

The Romanian city of Galati, where the last major Danubian tributary, the Prut, enters the basin from Moldova to the north, is the river's chief port for oceangoing vessels, although it is 90 mi (145 km) from the Black Sea. Ships traverse the largest of the three main Danube channels (the Sfîntu Gheorghe) to enter the Black Sea, and thus to the Mediterranean. It is estimated that 100 million tons of cargo are transported each year on the Danube as a whole, underlying the economic importance of this waterway to much of Central and Eastern Europe.

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## Danubian Gates

FOR CENTURIES, traffic along the DANUBE RIVER was hindered by a stretch of treacherous rocks and narrow gorges at the point at which the river cut through the Southern Carpathian mountain range. This stretch, about 62 mi (100 km) in length, along the border of ROMANIA and Yugoslavia (SERBIA), is known as the Danubian or Iron Gates, "Portile de Fier" in Romanian, and "Djerdap" in Serbian.

This barrier long formed a boundary between lower river commerce (to the BLACK SEA), and the river traffic of the upper Danube basin. The river flows through crystalline schists, limestones, and Sinaia strata (local Romanian stone), with both dangerous rock outcroppings in the riverbed, dangerous curves, and intense currents as the gorge reaches its narrowest points. The waters were most dangerous during low water periods (summer and autumn), and especially at night, when the height and verticality of the gorge walls allowed for extremely limited visibility.

Man added further dangers over the centuries, with nearly impregnable fortresses built by robber barons and extortionist princes. Most famous of these was the fortress Tri Kule, near Svinita, built by a Transylvanian prince to prevent Turkish infiltrations into the middle and upper Danube areas. But commerce continued. A

system of mule tracks and rope attachments were long in operation to drag boats through the area, and as the region freed itself from Turkish rule, several large channel-cutting projects were attempted, most notably by Serbia in 1890–98, with the construction of a series of canals between Virciorova and Gura Vaih, the most dangerous section of the gorges, which introduced the use of trains to pull boats upstream instead of mules. Other projects included the Sip Channel, underwater rock blasting, transverse and longitudinal embankments, beacons, signals, and so forth.

But along with this challenge of commercial transport, governments of the region realized the potential for hydropower also provided by such a concentration of water in a narrow space. More than two-thirds of the Danube basin as a whole lies above the Iron Gates, with a catchment area of 219,089 square mi (567,440 square km) from the Alpine, Dinaric, and Carpathian zones, producing an average flow of 194,936 cubic ft (5,520 cubic m) per second. The Iron Gates Navigational Authority was established in 1948 by Yugoslavia and Romania to examine both issues of facilitated transport and development of hydropower potential. In 1956, this body set out initial plans to build a "hydro-energetical navigational system." Work was begun in 1964, and full operation began in 1971. This remains the largest hydropower dam and reservoir system along the entire Danube, but as western institutions have begun to have closer access to the region, some wider issues have been raised, notably concerning the system's environmental impact, including upriver silting, downriver erosion, loss of animal habitat and worsening water quality.

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## Darien Gap

STRADDLING THE BORDER of the republics of PANAMA and COLOMBIA, the Darien Gap is home to one of the least exploited and most diverse ecosystems in the world. Flanked by the PACIFIC OCEAN to the north



and west and the CARIBBEAN SEA to the east, the area includes two national parks, Darien National Park in Panama and Los Katios National Park in Colombia. The area is 30 mi or 50 km wide, from the North Pacific Ocean to the Caribbean Sea, and 54 mi or 84 km in length, when measuring from the terminus city of Yaviza in Panama to Lomas Aisadas in Colombia. The Darien Gap harbors varying landforms, from swamplands on the Colombian side to the mountainous rainforests with its tallest peak, Cerro Tacarcuna (standing at 5,535 ft or 1,845 m), on the Panamanian side. With more than 3 million acres of wilderness, the ecosystem found within is one of the most hotly contested, a political and environmental quagmire.

The Pan-American Highway, stretching approximately 16,000 miles or 26,000 km from ALASKA in the UNITED STATES to the Tierra del Fuego region of CHILE in South America, is broken only by the natural barrier of the Darien Gap. Initial plans to construct a road through the Darien Gap commenced in 1923 at the Fifth International Conference of American States. One of the primary reasons for the road is that through its completion, trade between North and Central America and South America would be more efficient with less reliance on the Panama Canal as the primary thoroughfare. Past opponents conferred that the spread of *aftosa*, or commonly known as foot-and-mouth disease, would possibly be spread from the cattle of Colombia to Central and North America if the road were built.

In 1991, the U.S. Department of Agriculture proclaimed this threat to be extinct. Road construction began in 1971 and lasted until 1974, when further construction was halted due to environmental concerns. During that time period, part of the area was officially put under protection through decree no. 84 for the Alto Darien Protection Forest. Since that time, the area was designated as a World Heritage Site as well as a United Nations-designated Man and Biosphere Reserve. The area is home to two major tribes and several smaller ones. The subsistence agricultural lifestyle of the Chocos (both Emberas and Vainanas) and the Kunas is threatened, as it will be a potential loss of their land and culture if the road through the Darien Gap comes to fruition.

The route has been fully surveyed and partially completed, yet the political, economic, and environmental issues surrounding its construction are the true barriers to its completion. The approximate costs for completion would be approximately \$200 million. Effective lobbying by environmental and indigenous

groups, costs associated with the road infrastructure, governmental bureaucracy, and the de facto control of the area by Colombian rebel groups have left the fate of the remaining 54 mi or 84 km of road in limbo. Widely publicized accounts of civilian kidnappings, drug-smuggling anarchy, and the controlling activities of Colombian rebel groups have made this area one of the most dangerous in the world.

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## Davis, William M. (1850–1934)

WILLIAM DAVIS WAS among the leading geographers of the early part of the 20th century. Today, Davis might be more narrowly considered a geomorphologist based on his major research interests. But in his time, Davis enjoyed considerable influence over the direction and conduct of geographical science, in the UNITED STATES and in Europe.

Born to a prominent Philadelphia family—his maternal grandmother was the noted abolitionist Lucretia Mott—Davis was educated at the Lawrence Scientific School, Harvard University, in the 1860s, where he earned a baccalaureate degree and a masters degree from the short-lived school of mining engineering. Following a brief postgraduate period of world travel and employment at an observatory in the southern hemisphere, Davis began to teach at Harvard as an assistant to Nathaniel Southgate Shaler. In spite of an inauspicious start as an academic geologist and geographer, Davis mastered several scientific disciplines (meteorology, geology, and geography) and advanced at Harvard largely through attention to his publications and reputation. He held visiting positions abroad, most notably at the University of Berlin, and retired from an endowed chair at Harvard in 1912. Even so, Davis remained active in science well into the 1930s and with Ellsworth Huntington participated in several explorations, including those to the Pamirs and the Pumpelly Expeditions.

Although his contributions to science were many, Davis is best known for his “geographical cycle,” or

“cycle of erosion,” a sweeping theory devised to explain all geomorphological phenomena by means of a method he called “genetic description.”

According to the geographical cycle, all landforms will be reduced, through erosion, to peneplains, or near plains. To account for the observation that few landforms are peneplains, Davis argued that observed landforms may be explained by the processes that formed and continue to form them, by the structure of the underlying soil and rock, and by the stage in the advancement toward peneplanation that is observed in the present. Differing conditions of process, structure, and stage, Davis argued, can account for all observed variations in landforms.

The description of a landform according to these three criteria yielded a “genetic description,” a description that—because it accounted for the geographical genesis of the observed landform—also provided an explanation. In addition, Davis believed that variations in observed landforms were sufficiently few in number that they could be organized into a complete typology of ideal types.

The cycle of erosion had an American flavor to it in that it synthesized empirical work pursued, primarily, by geologists of the U.S. Geographical Survey in the late nineteenth century, among whom the best known are John Wesley Powell and Grove Karl Gilbert. At the height of his career, Davis’s primary interest was that European geographers, particularly leading German geographers, adopt the cycle of erosion. This was a campaign in which he was not altogether successful.

Davis was, by all accounts, an ambitious scientist. Moreover, his career coincided with the rise of doctoral programs in the sciences at American universities, and with the organization of American science into increasingly specialized disciplines and subdisciplines through scientific associations. He was a major participant in the creation of more than a dozen associations and served as president of both the Geological Society of America and the American Association of Geographers. His papers were published in the earliest volumes of a variety of journals, including *National Geographic* magazine, which he later abandoned when the journal veered from its initial intention to publish original research. At professional meetings and scientific conferences, Davis was well known for insisting upon high standards of research; his interventions in sessions occasionally bordered on bullying.

Following his death, Davis’s lingering influence on geography appeared to dwindle substantially, though interest in “Davisian” geomorphology reemerged by

the 1980s. In one area, however, Davis’s impact on geomorphology and in geology has been substantial and unabated. This influence is in the use of block diagrams and other diagrammatic techniques to present and summarize empirical research and scientific theory. Davis was, and remains, the undisputed master of the block diagram.

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## Dead Sea

THE DEAD SEA IS a 390-square-mi (1,010-square-km) salt lake located on the borders of PALESTINE, ISRAEL, and JORDAN. It is the lowest water point in the world, and its coast, at 1,292 ft below sea level (-395 m), is the lowest dry point on Earth. The lake is divided into two unequal parts by el-Lisan or “the Tongue,” which is a wide peninsula jutting from the lake’s southeastern shore. The northern part is larger and deeper, reaching 1,300 ft (400 m) in depth. In contrast, the southern side reaches only 35 ft (11 m) and averages only 13 ft (4 m) in depth.

The Dead Sea formed when two plates of the Earth’s crust began spreading apart, creating a low region, the Rift Valley system, where the crust is stretched quite thin. The Dead Sea is located in the region where the Earth’s surface has sunk, and the lake’s bottom is still sinking, as much as 13 in (33 cm) annually, an incredibly fast rate. In contrast, on the eastern and western sides of the lake, looming mountains range from 2,500 to 4,000 ft (762 to 1219 m) in height. The Jordan River is on the lake’s north, and hills of solid salt (Jebel Usdum or Mount Sodom) rise up on its southern border. Lower than surrounding topography, the Dead Sea is fed over 6.5 million tons of fresh water by the Jordan River and smaller streams every single day. (It should be noted that large-scale Is-

raeli and Jordanian irrigation projects along the Jordan River have been causing the depth of the Dead Sea to decrease over the past 50 years; pollution is a concern.)

Because the lake has no outlets and is completely LANDLOCKED, the only way that water leaves is through evaporation; because the Dead Sea is located in a hot area with low precipitation, water evaporates to the degree that the sea level seldom fluctuates, other than because of irrigation, and what is left behind is the salt. Twenty-seven percent of the Dead Sea consists of solid substances, including sodium chloride, magnesium chloride, calcium chloride, potassium chloride and magnesium bromide. Potash, bromine, gypsum, salt and other products are commercially extracted from these waters, which become saltier as depth increases. At about 130 ft (40 m), there are approximately 300 grams of salt per kilogram of water, which is about 10 times the saltiness of typical ocean water.

Once the depth is greater than 300 ft (91 m), there are 332 grams of salt per kilogram, which is a state of saturation and explains the piles of salt found at the lake's bottom. Due to this extreme saltiness, the Dead Sea supports no plant, animal, or fish life. If a fish swims from a stream into this lake, it is instantly killed and then preserved by the lake's mineral salts. The only types of life, then, existing in the Dead Sea are microbes and highly specialized algae; on occasion, a seabird is seen resting on the lake's surface.

Humans can swim in Dead Sea waters, but because of the extraordinarily high salt concentration and density of the water, the experience is more like floating. When a person exits the lake, the body is coated with white salts, just as the shores of the Dead Sea are covered with this substance, and the person's skin can become irritated. The salts can irritate the eyes, and the water, if swallowed, tastes revolting because of the chloride of magnesium. Chloride of calcium gives the water its oily appearance.

The name *Dead Sea* is used in the Old Testament, although other biblical names are also listed for this body of water, including the Salt Sea, East Sea, Sea of the Plain, and Sodomitish Sea; the ancient cities of Sodom and Gomorrah were located at the lake's southwestern coast. Yet another name is the Lake of Asphalt, given because of the quantities of bitumen that rise to the surface of this lake, and current inhabitants call this body of water the Sea of Lot.

This region is famous for the Dead Sea Scrolls found in 11 caves in nearby Qumran from 1947 to 1956. Literally thousands of Biblical fragments and ancient Jewish documents were found, which added

greatly to the understanding of these religions. Today, the shores of the Dead Sea contain popular beaches, resorts, and spas.

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## Deccan Plateau

LOCATED IN INDIA, in the southern part of the peninsula south of the Indo-Gangetic Plain, the Deccan Plateau can be considered the cultural and historical heart of India, defining the subcontinent. The great epic poems of the Vedas tell of the coming of the Aryan-speaking peoples that dominate all of northern India today. However, the very peoples they supplanted did not disappear but were concentrated in the Deccan and maintained distinctive cultures and language groups.

Remnants of a predominantly indigenous Dravidian culture (pre-Aryan) exist in the Tamil kingdoms found by the ancient Greeks. Tamil literature from 300 B.C.E. records the social life and academic accomplishments of these peoples. Three great Tamil dynasties emerged and challenged one another in internecine fighting. The rise of Buddhism in north India did reach into the Deccan, but the south remained resistant to the kings and Moguls that came in history's wake. Islam never made significant inroads into the Deccan Plateau. The coming of the Europeans from the 15th century onward gradually affected the coastal areas and even the interior Deccan gave way under the British raj (ruler). Characteristic of their distinct culture and history, many calls for independent states have arisen since the establishment of the Indian Union in 1947.

The Deccan Plateau is believed to be an ancient remnant of the Earth's original continent, Gondwanaland, which broke up to create the continents we know today. The plateau is a great ancient shield of basalt lava that now bears the scars of its long exposure to the

weathering effects of wind and water. The Vindhya Range marks the margins of the southern reaching peninsula and the Indo-Gangetic Plain. The Deccan is uplifted between 2,625 and 4,600 ft (800 and 1,400 m). The western Ghats increase in average height as they go south, reaching a maximum of 8,842 ft (2,695 m) in Kerala. The narrow coastal plain between the western Ghats and the ARABIAN SEA is marked by lagoons and backwaters. The plateau is primarily drained to the east with the headwaters of the Krishna, Bhima, and Godavari forming in the western Ghats and flowing up to 3,280 mi (1,000 km) eastward across the plateau to the BAY OF BENGAL. The eastern coastal plain is much broader and marked by the deltas of the Godavari, Mahanadi, and Kaveri rivers. The central Deccan is a series of smaller plateaus topped with rolling hills and dissected by many watercourses.

The monsoon cycle of dry and wet seasons affect the entire peninsula. The plateau has sparse but continuous dry deciduous forests across its southern third and along the eastern Ghats. To the north and in the central portions, the forest gives way to scrubland.

Over 300 million people live in the greater area of the Deccan Plateau. Sustainable resources such as forests and water are under increasing pressure. Deforested areas are being replanted with extensive monoculture that will further deplete the diversity of the ecosystem. Silting of reservoirs has been a historic problem and accelerated damming of water courses bodes ill for the long-term management of the various watersheds. Mining of the Deccan rich mineral deposits has not modernized. Techniques for the full recovery of the potential ore, management of overburden removal, and control of toxic wastes are all required.

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## Delaware

DELAWARE IS ONE OF the Middle Atlantic states of the UNITED STATES. It is also the country's second small-

est state after RHODE ISLAND, covering 2,057 square mi (5,328 square km) within the DELMARVA PENINSULA. It is bordered by MARYLAND on the west and south, NEW JERSEY to the northeast across the Delaware Bay and Delaware River, and there is a short border with PENNSYLVANIA in the north. The state's 783,600 residents (2000) share their part of the peninsula with Eastern Shore Maryland and VIRGINIA. The area is part of the Atlantic Coastal Plain, which runs for more than 2,200 mi (3,667 km) from Cape Cod to the Gulf of Mexico. The countryside is relatively flat, with the land rising gently from sea level in the areas along the eastern shore to 442 ft (135 m) in the Piedmont region along the border with Pennsylvania. The southern part of the state is mostly swampland. A number of small rivers flow across the state, flowing either east to the Delaware (the Christina and Brandywine) or west across Maryland to the Chesapeake Bay (the Nanticoke). The state capitol is in Dover, although Wilmington is the largest city with 72,664 residents.

When Henry Hudson sailed into the Delaware Bay for the Dutch East India Company in 1609, he found the area of sand dunes, swamps, and gently rolling hills inhabited by Native Americans (Nanticoke and Minqua). Although both English and Dutch interests vied for the region, the Dutch established the first settlement in 1631. Within a year, however, that settlement was destroyed by a rare Native American attack. For the most part, the area's Native Americans were friendly and open to trade and within a short time several Dutchman interested in settling the area received permission to colonize the area for Sweden. Peter Minuit, one of the more notable of the early settlers, led the expedition for the Swedes, organizing New Sweden and founding Fort Christina on the site of today's Wilmington in 1638. Following a number of battles among the English, Dutch, and Swedes, the area was finally turned over to England in 1674, where it remained until the American Revolution. The Colony of Delaware became a state in 1776 and was the first state to ratify the new Constitution of the United States in 1787.

By the end of the 18th century industry was making inroads in Delaware. In the Piedmont region of the north with the rolling wooded hills, the Brandywine and Christina rivers provided ideal locations for gristmills to grind grain into flour. At the same time, Wilmington became a center for the manufacture of cloth, paper, and flour products, an industrial sector that flourished into the 19th century. The Du Pont family established a gunpowder mill on the Brandywine River



in 1802, marking the beginning of what would become one of America's most successful family business empires.

More recently, the finance and insurance sectors have become increasingly significant employment and income generators, although manufacturing and agriculture are still important. The manufacturing, credit card, banking, and insurance industries are heavily concentrated in the north. Broiler chickens, soybeans, corn, and dairy products comprise the heart of a still vibrant agricultural sector, utilizing lands generally below the Chesapeake and Delaware Canal in the south. Potatoes and other vegetables are also grown; in addition there is a small fishing industry centered on harvests of clams, menhaden, oysters, and scup.

Because Delaware has some of the more lenient laws regulating business taxation and practice, the state is home to many of the largest corporations in the United States. This is especially true for those in the banking and financial services sectors, and these now dominate the state's economy. The chemicals and materials monopoly that was founded by the Du Pont family in the 19th century, despite being broken up by the government in an antitrust suit in 1912 and losing another suit in the 1950s over the firm's major interest in General Motors, continues to be one of the largest corporations in the world. In addition to chemicals and chemical products, the biomedical, apparel, processed foods, rubber and plastic products, and transportation equipment industries are important and contribute to the state's wealth.

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## Delmarva Peninsula

THE 5,940-square-mi (15,384 square km) Delmarva Peninsula is located in the mid-Atlantic area of the UNITED STATES and borders the Chesapeake Bay, the Delaware Bay and the ATLANTIC OCEAN. The historic importance of the area is that it formed an important political and social demarcation between the North

and the South of the United States: the Mason Dixon Line.

The border between MARYLAND and DELAWARE formed the initial portion of the Mason-Dixon line, drawn in the mid-1700s to settle a boundary dispute between the Calvert family and the Penn family. The Mason-Dixon line later became the delineation between northern states and southern states, and therefore between slave states and free states. The name Delmarva comes from letters in the state names that share it, including all of DELaware, and portions of MARYland, and Virginia.

Compared to the rest of the United States, the Delmarva Peninsula is strikingly flat, with most of the area approximately 30 ft (9 km) above sea level. Interestingly, this area was not always flat. Two hundred million years ago, the APPALACHIAN MOUNTAINS were the edge of the ocean. The shoreline itself then was rocky, resembling a steeper version of the current coast of MAINE. The long, flat, sandy beaches that characterize today's Delmarva coastline emerged because of continental drift. The Appalachians have been moving westward for 245 million years, and they've been doing it at a yearly rate that just about equals the speed at which fingernails grow. As the Appalachians were drifting westward, they also eroded. Their rocks were weathered into sand. This sand was carried by streams and rivers to the coast and deposited. Over time, these deposits, once under water, have been exposed and now form the coastal beaches.

### CHANGING GEOGRAPHY

Today, coastal currents and storms are changing the geography again. This can be seen even in maps of the area between the coastal towns of Rehoboth and Cape Henlopen. These show that since 1878, the shoreline has moved almost 1,200 ft (366 m) inland. The wide sandy beaches of Delmarva are a major tourist destination and a major economic resource for the area. Maryland's heavily developed Ocean City has a year-round population of less than 10,000, but during peak summer weekends, the population swells to more than 300,000.

With a shallow and changing coastline and a lack of natural harbors and energy resources, Delmarva did not become heavily industrialized as did some of its neighboring areas. Today, intensive truck gardening agriculture, poultry farming, and the seafood industries form the backbone of the peninsula's economy. Its strategic location, just a few hours from Baltimore, Washington, D.C., and Philadelphia, with overnight

access to almost one-third of the nation's population, have made it a major food supplier for the East Coast of the United States.

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## delta

A DELTA IS AN AREA of land that has been built up at the mouth of a river, where it flows into a quiet body of water, such as a lake or an ocean. The delta is formed when the river, which is moving swiftly and carrying sediment such as mud, slows down to enter the larger body of water. At the slower speed, the water can't carry as much sediment, so most of it is dropped onto the bottom of the ocean. It builds up layer by layer, over a long period of time, until it is above the surface of the water.

The delta builds up at the end of the river itself, since it cannot rise higher than the surface of the ocean. As more and more sediment is deposited, the delta grows in size and extends further upstream. The more mud the river carries, the faster a delta will build up. Most deltas have a roughly triangular shape. The name came from the Greek letter delta, which is shaped like a triangle. If plants grow on the delta, their roots and remains become part of the soil, enriching it. A delta is an ever-changing landform. If the original channel of the river is filled with sediment, the stream will overflow across the surface of the delta, dividing into smaller streams or channels called distributaries.

The size and shape of the delta depends on several factors. If the waves are strong where the river enters the ocean, any deposits will be washed away and a delta will not form. The weaker the waves in the ocean at that point, the more the delta will build up. Delta formation is also dependent upon the amount of material being carried by the river. If waves are not very strong, the delta will grow rapidly, with long fingers of land building up along the distributaries. This is called a bird's-foot delta.

Throughout history, deltas have been important to civilizations. The soil of a delta is usually very fertile and is good for farming. Delta lands often flood every year, spreading another layer of silt. Many deltas have unhealthful climates and poor drainage, but still tend to support dense populations of people. All over the world, deltas have influenced the lives of people. Some of the most important deltas include the MISSISSIPPI RIVER delta, the NILE RIVER delta, and the delta of the GANGES river.

The Mississippi River delta is located at the southern edge of the UNITED STATES, where the Mississippi River empties into the Gulf of Mexico. South of New Orleans, LOUISIANA, a bird's-foot delta has built up. The resulting valley provides habitat for many species of plants and animals important to the ecology of the area. Farms on the delta produce much of the country's supply of soybeans, rice, sugarcane, and cotton. The Mississippi River still deposits sediment on the delta. In some places, more than 98 ft (30 m) have been deposited in the last 100 years.

The Nile delta is located at the northern end of the Nile River, where it flows into the MEDITERRANEAN SEA in EGYPT. The Nile is the longest river in the world. Most of the delta's surface is covered with crops, contrasting sharply with the barren desert around it. Cairo, the capital of EGYPT, is an example of a delta supporting a dense population. The city has a population of more than 11 million people, which is more than 26,000 people per .386 square mi (1 square km). At its widest, the delta is about 153 mi (250 km) wide along the Mediterranean.

The Ganges-Brahmaputra delta was created by sediments deposited by these two great rivers in the area of BANGLADESH. People have built their homes on artificially raised earthen hills to protect them from the yearly floods. Like the Nile delta, this region is overpopulated. Population density far exceeds 500 people per .386 square mi (1 square km). Over 300,000 people were killed by floods there in 1991. Farming is almost the sole occupation on this delta.

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## demographics

DEMOGRAPHY IS THE study of populations (a term used to denote the collection of persons alive at a particular point in time and who meet certain criteria). Demographics have to do with population statistics. Usually referred to as a census, most often these data are collected through a survey process and by public agencies at all levels of government or non-governmental organizations. These data include variables representing vital economic and social statistics. They generally include race, age, gender, religious affiliation, educational levels, income levels, and housing and employment information. They also include information about population density, which is the number of people per square mile, as well as how the total population and population subgroups are distributed throughout a selected geographical area. The information collected by agencies may include data on death and birth rates, life expectancy, and health problems, to name a few. When linked to basic demographic data, researchers can better understand links between these variables; for instance: the life expectancy of American males who are of Hispanic ethnicity and have yearly incomes below \$18,000.

Most countries have a formal census process that attempts to count every member of the population and to collect information about that person and his or her household. All of this individual data is then aggregated (combined) and sorted by variables to inform us about the people in a particular area. For most of Europe, census taking dates back to the 16th century. The founding fathers of the UNITED STATES recognized the value of collecting population data and ensured that the process would be funded and protected by the U.S. Constitution.

The U.S. Census Bureau conducts a census every 10 years. In addition to taking a “head count,” each individual is asked to identify sex, age, relationship status, race, whether or not of Hispanic origin, and housing tenure and ownership status. Approximately 15 percent of the population is selected randomly to receive a longer survey from which additional demographic information is collected. These additional demographic data include marital status, place of birth, citizenship and year of entry, ancestry, place of residence five years ago, language spoken at home, veteran status, disability information, present labor force status including industry, occupation, and class, place of work and journey to work, previous year’s work status, and previous year’s income. Housing data, which are socioeco-

nomics indicators, are also collected. Statisticians also use equations to make assumptions about the U.S. population at different levels of geography (local, state, country) and cross-reference socioeconomic data with demographic data to create population profiles. The smallest census geography is a “block.” It represents approximately 150 people and gives a very detailed picture of the people who comprise a small area while protecting each individual’s right to privacy.

Developing countries also recognize the need for population counts and surveys but are often impeded by resources, political strife, and massive shifts in population resulting from civil war, famine, etc. These countries are aided by organizations like the United Nations in collecting important demographic data to aid economic development and stability through resource management.

The process of collecting demographic data is becoming more complex as the world’s population increases and many countries, such as the United States, become more heterogeneous and mobile. As a result, understanding demographics has also become more complicated because many individuals no longer fit neatly into one particular race or ethnicity category. Further complicating the process in all countries is the fact that many census takers and demographic researchers are challenged by accuracy problems resulting from community and individual reluctance to report personal information.

Demographic data provides students, researchers, and decision makers with information that is essential to understanding our world. It allows us to identify social groups, shifts in populations through migration and immigration, relationships between people and geography (cities, states, countries, world regions, and the world as a whole), as well as relationships between people, political boundaries, and resources. Demographics have a wide scope of applications. For example, private industries might use census data and market research for product development, targeted advertisement of services and products, and selecting new markets/locations for business development.

Demographics also play a vital role in how government dollars are allocated. Some of these decisions are linked to total population numbers, while others are linked to particular demographics such as age, race, gender, income, or a combination of these. Additionally, nonprofit organizations might use demographic data to improve service delivery by targeting geographic areas with assumed specific needs based upon the area’s demographic profile.

Demographic data not only provide information about today, they also help us establish population trends that can help predict and prepare for the future. Newer demographic changes make it difficult to measure and understand the sources for that change until more data is collected over time. An example: in 2000, the U.S. Census Bureau began collecting information about grandparents serving as caregivers; the true scope of this demographic shift will not be measurable until the same data is collected again in 2010. Likewise, some changes have been gradually occurring over a longer periods of time and substantial data have been accumulated for examination. These data and changes allow researchers to use statistical modeling to project future population trends and make recommendations for preparation and response. By doing so, decision-makers such as politicians and organizational leaders have information to guide them in allocating resources to plan for future need and demand on resources.

Population growth tends to be very imbalanced between rich developed countries and poorer developing and third world countries. Countries in Asia and Africa have large population numbers of people under the age of 15, whereas countries in North America and Europe have fewer young people and rapidly aging populations. These basic statistics indicate very different demographic futures as well as different demands on resources. A younger population will require more schools and job training, whereas an older population will require increased geriatric programs and services to respond to long-term health problems that result from aging. Governments and agencies can use this information to plan for these needs. Private sector businesses can also use these projections for business development.

Population change at all geographical levels will eventually affect economic consumption, social and political relationships, and environmental outcomes to name just a few of the impacts. Without demographics, many decisions about natural and monetary resources would be random, and it would be difficult to project long-term impacts to allow better use of the world's and countries' limited resources.

### VISUALIZING DEMOGRAPHICS

Demographics are inextricably linked to geography. As a result of the internet, we can easily access data about the world's population as a whole or by region, a country's population, a state's population, or a city's population. Sophisticated mapping software, such as geographic information systems (GIS), provides the

technology to link demographic data to their respective locations. By examining demographics and linking them to place, we learn a lot about the available labor force, the need for age-appropriate services (such as day care or day programs for the elderly), and we can make assumptions about quality-of-life issues. For example, an area populated with people with moderate incomes and college educations will likely have better quality of life, through access to resources, than areas with high poverty and low education rates. Many demographic data have been mapped and made available to the public. These maps allow us to see patterns that may not be obvious when looking at numbers.

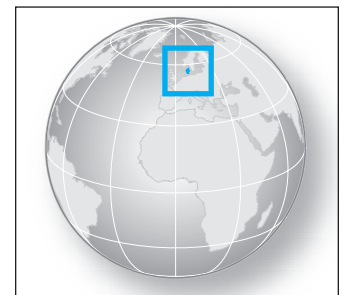
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## Denmark

**Map Page** 1130 **Area** 16,807 square mi (43,094 square km) **Population** 5,384,384 **Capital** Copenhagen **Highest Point** 571 ft (173 m) **Lowest Point** -23 ft (-7 m) **GDP per capita** \$29,000 **Primary Natural Resources** petroleum, natural gas, fish, salt.



DENMARK IS A COUNTRY whose history and culture is almost entirely shaped by the sea. With a coastline of 4,535 mi (7,314 km), nearly 500 islands, and numerous fjords and inlets, nowhere in Denmark is more than 31 mi (50 km) from the sea.

The Danes have traditionally played a role as a bridge between the language, culture, and politics of Central Europe and the Nordic nations of Scandinavia.



Denmark is the smallest of the Nordic countries but has frequently been the dominant member, with the highest population and strongest economy.

Denmark consists of the peninsula of Jutland, connected to northern GERMANY through the province of Slesvig, plus the main island of Zealand (Sjælland), which includes the capital of Copenhagen and nearly half the population and a number of smaller islands. Most of these islands are clustered in an archipelago to the east of Jutland, in the southwest corner of the Baltic Sea: Fyn, Lolland, Falster, and Møn. Other islands, generally long and thin, lie off the west coast. These are the northern Frisian islands, including Fanø and Rømø.

The island of Bornholm lies about 80 mi (130 km) to the east in the Baltic Sea, a relic of a time when Denmark's kings completely controlled the Baltic. This control was due to the strategic placement of Denmark along the narrow series of straits that connect the Baltic to the North Sea: the Skagerrak, the Kattegat, and the Øresund. The Øresund in particular is only about 12.4 mi (20 km) wide, and until the 17th century, Denmark controlled both shores, effectively controlling all shipping access in and out of the Baltic Sea. Today, the eastern shore of the Øresund is part of SWEDEN, and since the completion of the monumental Øresund bridge and tunnel system in 1999, it has become more a connector between the two countries.

Jutland is almost entirely flat, particularly along the western coast, where dikes are necessary in some places to keep out the sea. Some areas in the center are hilly, but the average elevation is only 98 ft (30 m). Much of this landscape shows the effects of glaciation through several ice ages: morainic hills, moors, and downs.

Several fjords indent the peninsula, notably Flensborg Fjord, which divides Denmark from Germany, the Åbenrå and Vohle fjords of the eastern coast, and the Lim Fjord, which slices nearly all the way through the tip of northern Jutland—with the creation of the Thyborøn Canal, this section of Jutland became, in fact, an island.

Denmark's largest city and major port is Copenhagen (population 1.4 million) on Zealand. Other major ports include Esbjerg, Ålborg, and Århus on Jutland. Other large cities are on the islands: Odense on Fyn (home of Hans Christian Andersen), Nykøbing on Falster, and Roskilde and Frederiksberg on Zealand. Lacking significant raw materials, Denmark made use instead of its position as a seafaring nation to import, process, and re-export products, creating one of the



*Boats at Nyhaven in Denmark illustrate the character of the country as inextricably linked to the sea.*

most dynamic economies in Europe. Its commercial fleet is the third-largest in the world, and its standard of living is among the highest. Most of the country remains, nevertheless, a largely agricultural country, and some of Denmark's chief exports are meat and dairy, in addition to the more high-tech pharmaceuticals and electronics and the world-famous Lego toys. Denmark joined the EUROPEAN UNION in 1973 but has resisted full integration into the economic union, opting out of the common currency in 2000. The Kingdom of Denmark also includes GREENLAND and the FAEROE ISLANDS, both of which have developed near total autonomy in internal matters since the 1970s.

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## desert

THERE IS A TENDENCY, in popular opinion and some public policy, to view deserts dismissively as unproductive wastelands. The 14th edition of the *Encyclopaedia Britannica* made the case with exuberant eloquence: "Desert, a term popularly applied to any environmentally extreme, deserted, desolate, uninhabitable waste area." While they are indeed less productive of biomass than other land areas at comparable altitudes and latitudes, deserts and their unique environmental characteristics have long interested physical geographers and ecologists. And while deserts do appear inhospitable, most have long histories and prehistories of human habitation and resourceful human adaptation to desert landscapes. Deserts account for a substantial fraction of the Earth's total land area, occurring in every continent but Europe and dominating northern Africa, Asia Minor, and central and western Australia.

The defining characteristic of a desert is a mean annual precipitation of 10 in (24 cm) or less. Climatologists refine this definition, however, by contrasting mean annual precipitation to rates of evaporation and transpiration, or water lost by plants. Ecologists may further stress adaptations of desert plants and animals to varying conditions of aridity over time. Although the climate of ANTARCTICA fits the climatological definition of a desert, and while it is so considered by some geographers, the special characteristics of the continent are generally excluded from discussions of desert geography and ecologies. The term is applied almost exclusively to land areas, but comparisons to comparably underproductive areas of open ocean can make for worthwhile ecological discussions.

Even if Antarctica is excluded, the global distribution of deserts is quite diverse. Deserts occur at tropical and temporal latitudes, centered on the Tropics of Cancer and Capricorn. Little of the land area at the equator (the exception is the HORN OF AFRICA) is desert. The greatest continuous land area of the world's deserts is

found in a band stretching along the TROPIC OF CANCER from the North Atlantic across Africa and continuing through Asia Minor and into regions of KAZAKHSTAN, northeast of the CASPIAN SEA. While most deserts abut oceans along a portion of their boundaries, a small number, including the GOBI DESERT, are LANDLOCKED.

Two climatological factors tend to create conditions of aridity and hyperaridity (very high ratios of evaporation and transpiration, or evapotranspiration, to precipitation). One factor is global atmospheric circulation, augmented by cold ocean currents: Most deserts are found in "horse latitudes," around 30 degrees latitude, and along the western coasts of continents. Under such conditions, air warmed near the equator circulates aloft to the north and south, cooling, sinking, and compressing as it reaches the higher latitudes. Deserts also occur on the leeward side of mountain ranges, where a "rain shadow" forms as air movement over mountains cools and condenses moisture in the air on the windward side, thus drying the air that passes to the lee.

Although the aridity of deserts is often associated with high surface temperatures, some of the world's deserts occur in regions of lower mean annual surface temperatures. These latter are therefore known as cold deserts.

Among the geomorphological features found in deserts, the best known are sand dunes. Dunes are not found exclusively in desert regions, however; they are products of eolian (wind-driven) processes that can occur under a variety of conditions. Even so, the bulk of the world's sand dunes are found in deserts. Geomorphologists classify dunes according to forms that arise in response to the supply of sand, the persistence of wind direction and speed, and the presence or absence of stabilizing vegetation. Steady winds, very low vegetation, and moderate sand supplies create barchans, dunes having a crescentic shape as viewed from aloft.

Rocky plateaus and plains formed from alluvium with little soil development are more universally typical of desert landscapes. In the deserts of North America, these occur in regions that have been extensively deformed by normal faulting, uplifting alternating blocks of crust relative to others. The resulting basin and range (or graben and horst) structure is characteristic. Basins become loaded with sediments that have eroded from adjacent ranges. Due to low precipitation and therefore low rates of sediment transport, sediments tend to be sorted with finer grains collecting at the centers of basins (known as bolsons), coarser grains



Although the world's deserts are less productive than other land areas at comparable altitudes and latitudes, their unique environmental characteristics include long histories and prehistories of human habitation.

at the margins, and the coarsest grains or talus found in the bajada, at the boundary between a plain and the uplifted pediment. The remains of an intermittent or relict lake at the center of a basin are called a PLAYA.

Soil development in desert regions is generally poor. Organic material is sparse, and aridity promotes preservation rather than decomposition. Under some conditions, especially in basin and range landscapes, sediments are reworked chemically, resulting in accumulations of soluble minerals such as gypsum and calcium carbonate. High concentrations of calcium carbonate can cement alluvium at the surface in caliche, or desert pavement.

In spite of the inauspicious conditions for life that obtain in desert regions, thousands of species of organisms have evolved to survive and even to thrive under such conditions. Typical adaptations in desert plants, for instance, include means to reduce transpiration and tissues adapted to store water against periods of drought. There is no one strategy for coping with arid conditions; some plants have taproots to reach down into sources of groundwater, while others have radial systems of roots close to the surface to maximize absorption when rain falls.

Humans have long inhabited, traversed, and found refuge in desert regions throughout the world, deriving sustenance by hunting and gathering, through agricultural practices that include but do not necessarily require irrigation, and as nomadic pastoralists. Growing and stratified or stratifying societies have emphasized agriculture, constructing IRRIGATION networks in many of the world's deserts to support sustained and reliable yields. Efforts to irrigate desert lands have tended to be limited in longevity because of the high rate of evaporation in desert climates, which results in an aggregation of minerals, unhealthy for plant life.

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## desertification

SINCE THE mid-1970s, the United Nations (UN) has considered desertification a significant environmental problem involving high economic, societal, and human costs. The UN's Conference on Desertification, held in 1977, outlined an action plan over a 20-year period that, unfortunately, did little to change the course of desertification.

The definition of desertification itself is controversial. In 1991, the UN Environment Program defined it as "land degradation in arid, semi-arid, and dry sub-humid areas, resulting mainly from adverse human impact." In 1992, the UN convened the Conference on Environment and Development (UNCED) to draw up formal measures that included setting up a Committee on Desertification to review reduction of greenhouse gas emissions, preserving biodiversity, and protecting international waters.

The official draft of the UNCED report expanded the definition of desertification to: "land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors including climatic variations and human activities."

The World Bank defines desertification as "a process of sustained decline of the biological productivity of arid and semiarid land; the end result is desert of skeletal soil that is irrecoverable [sic]. Common indicators include a reduction in the amount of diversity of plant and animal species, loss of water-retention capacity, lessened soil fertility, and increasing wind and water erosion."

The key issue in desertification is the presence of climate variation, as experts point out that the more important dimension of the problem refers not to the expansion of existing deserts, but to the result of human activity in dry land masses, as land is exploited and inappropriately managed. Desertification is not only intrusion by sand dunes; it is gradual loss of soil fertility from excessive cultivation or grazing, destruction of trees and shrubs for firewood, and the lack of effective water resource management.

Desertification can happen through natural causes in any climate zone. The areas at risk are mainly in Africa, but also extend to Asia and the Americas, including the western portion of the continental United States. The expansion of such vast deserts as the SAHARA, GOBI, and the Arabian are not the main concern, scientists say. Rather, areas that are gradually drying out, making the practice of farming progressively unsustainable, are becoming sources of global ecological

and human concern. In marginal areas, where natural resources are depleted over time and the land becomes unproductive, starvation may ensue.

### 1 BILLION PEOPLE AFFECTED

The UN reports that, currently, desertification affects about 8.9 billion acres (3.6 billion hectares) or 70 percent of all "dry" lands across the globe. That is nearly one-fourth of the total land area on Earth, affecting about one sixth of the world's population. Over one billion people all over the world are affected by drought and desertification. Populations in these areas occupy about one-fourth of our planet and face major catastrophes as a result of such climate change, including deterioration of vulnerable land, and eventually chronic food insecurity and starvation.

As desertification takes hold, farmers give up trying to grow crops and move to cities in search of work. Cities are then faced with deciding how to deal with resulting overpopulation and lack of sufficient food resources. The ultimate consequences of desertification include economic loss, poverty, famine, human suffering, and widespread death. Strategies to deal with desertification address poverty, land ownership, and social structures. Because large regions generally suffer an inability to maintain adequate standards of living for their population when desertification occurs, the expanding loss of productive lands has a domino effect, bringing down entire communities.

Naturally occurring processes formed deserts over long periods of time, and over time, most deserts have grown and shrunk, irrespective of human intervention. In many cases, desert edges may become more humid than dry, making it harder to define a desert border. These areas maintain very fragile ecosystems because of different climates. Small hollows may support vegetation that insulates heat and protects the area from winds, and these vegetated areas may be cooler than their surroundings, resulting in various microclimates. If humans are involved in using these areas for farming, for example, they may stress the ecosystem beyond its capacity, resulting in more degradation of the land.

Overpopulation and resulting excessive cultivation and grazing leads to falling soil fertility and lesser crop growth. Exposed topsoil is further eroded by the elements and is conducive to surface runoff and erosion. Eventually, this vicious cycle results in destruction of crops and more infertile land.

Overgrazing is a significant factor in land destruction that causes a decline in vegetation including grasses; excessive grazing results in the replacement of



perennial grass species with species of forbs (weeds) that do not hold soil as efficiently as grass does. Soil is also compacted by livestock trampling near watering holes, and dunes are overrun and destabilized after relatively short periods of grazing time. These cumulative processes cause a significant decline in the health of the very animals that depend on the land for sustenance, as well as the often permanent and irreversible result of desertification.

### REDUCING DESERTIFICATION

The UN has identified various strategies to reduce further land erosion. Early warning systems and knowledge of water resource management techniques assist communities to maintain the integrity of land. Careful land and livestock management is essential to preserve fertile ground, and the use of special seeding techniques over sand dunes can manage vegetation. Narrow strip planting and reforestation of new species and varieties that can tolerate extreme weather conditions are other effective ways to regenerate crops and native flora. Sheltering of native plants is important in maintaining ecological balance, so “social forestry,” a process in which villagers take responsibility for forests that surround their village, is a method of empowering those directly impacted by the degradation of productivity.

Global awareness is essential in understanding the magnitude of desertification. Unlike other catastrophic natural disasters—such as CYCLONES, for instance—desertification happens over a long period of time; it is thus easier for communities to overlook its effects and adjust to the status quo. As such adaptation exacerbates the social effects of desertification, governments need to take the lead in preparing communities to deal with the problem.

The UN’s Convention to Combat Desertification Treaty, ratified in 1996, is intended to promote effective local programs and international partnerships to combat the problem globally. The World Bank has also cooperated in the global effort to stem the destruction of land by deploying and mobilizing its resources in concert with global needs. Education, focusing especially on local and international actions that threaten landmass, is needed to develop positive changes that can result in increased food security and amounts of land available for food production.

Desertification is not an easily solved problem for a government and its people. It is difficult for citizens to understand that they must be more responsive to land use issues. Countries that may not be directly affected should take into consideration the global seriousness of

desertification and take steps to alleviate its effects and prevent its expansion. Desertification causes increased flows of refugees, which affect all countries because migration almost certainly ensues when a land region cannot sustain its native population. Countries are often forced to take on fleeing immigrants, and other countries find themselves having to commit scarce financial resources to combat—or help other nations combat—the catastrophic effects of desertification. Desertification is a global problem with devastating results for planet Earth.

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## determinism

DETERMINISM (from the Latin *determino*, meaning “define”) is a basic philosophical theory about general interdependence and interconditionality of phenomena and processes. This idea was explained for the first time in ancient natural philosophy (atomistic ideas, peripathetic school), in notions about primary origins and elements. Later, it was developed by Persian poet Omar Khayyam, Italian naturalist G. Bruno, and others who believed in the existence of cause and effect as a rational consequence.

Laplace’s determinism is the first attempt to generalize and theoretically interpret general deterministic ideas, proposed by Pierre-Simon, Marquise de Laplace, the 18th-century naturalist and philosopher. According to his variant of determinism (sometimes called strict

or mechanistic determinism), everything in the contemporary world (and the human being itself, taken as a biological and social creature) is completely caused by previous facts and events. He believed that the unidirectional and dynamic connections of any phenomenon's states could be described with the help of laws of physics and mechanics.

According to Laplace, the universe is utterly rational, and complete knowledge of any given situation permits us to experience with certainty the future and the past of any unit.

### **GEOGRAPHICAL DETERMINISM**

As a particular form of strict deterministic theory, geographical determinism approves geographic environment as the principal determinant of social layout and cultural development. As early as at the middle of 4th century B.C.E., it had been designed as a specific direction of philosophic thought, with at least two extreme schools: one of climatic psychology and one of climatic ethnology. Later, climatic astrology originated.

The Enlightenment and modern ideology reconsidered these ideas in a framework of establishing general regularities in livelihood systems, social spheres, and political organization. During the 20th century, geographic determinism was associated mainly with theories trying to explain the unevenness of social and cultural development of separate countries and peoples exclusively by peculiarities of their natural habitat. Today, geographic space influences political decision making and is the subject of scientific modeling of geopolitics, which is regarded as a special discipline, formed on the border of anthropogeography, political geography, and political science.

### **MARXIST DETERMINISM**

Marxist determinism emphasizes total objectivity, interdependence, and interconditionality of objects, facts, and phenomena of the real world. Apart from causal interrelations, Marxist determinism presumes the existence of a wide spectrum of interconnections of different kinds, such as spatial and chronological correlation, functional dependence, symmetry connection, system elements interaction, mutual determination of part and the whole, connection of states in development and movement, and so on.

In such contexts, social regularities define the mainstream of historical process but do not determine the whole diversity of individual and group activity. So freedom in purpose formulation is ascribed to the human being and to the social group as well.

Economic determinism stresses economic primacy in relation to other form of social practice. In its Marxist variant, the economy is regarded as a sphere of human activity that determines (or, at least, influences decisively) the character and essence of political and social processes. On this basis, society's historical development could be conceptualized through the series of socioeconomic formations (primitive, slavery, feudal, capitalistic, and communist). In such a context, state, ideology, politics, and culture are regarded as expressions of economics, which, in its turn, reflects the interests of the dominative class and results from the mode of production. In a broader sense, economic determinism implies that political and social infrastructures are conditioned by the character of the economy.

### **STATISTIC AND SYSTEM DETERMINISM**

The 20th century brought new insight to deterministic ideas thanks to the origin of statistic and probabilistic methods of scientific research. As a result, statistic regularities (instead of total and exhaustive causality) were revealed and conceptualized in the framework of a wide spectrum of probabilistic world theories.

Statistic determinism is widespread, mainly in the context of sociology, demography, and other social sciences. It presumes that in large sets of social phenomena, one can trace statistic regularity or the general tendency of development. In such a context, character of social connection is interpreted as possibilistic and regular at the same time.

System determinism (or determinism revealed in the framework of theory of system) implicates the integrity of elements forming the social system and acts as a some kind of basis of these elements' peculiarities and their changes in time and space.

Both system and statistic determinism don't deny the role of conscious and targeted human activity. They pay special attention to the mode by which the main purpose of such activity is formulated. Into the 21st century, deterministic ideas are withstanding indeterminism, which denies the existence of objective causal regularities.

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## Dhaka

DHAKA BECAME the capital of the newly formed sovereign state of BANGLADESH in 1971. The city has a tropical monsoon climate with heavy summer rainfall (June through September), about 80 in (203 cm) annually. Summer is hot and humid and winter is dry and mild.

It is located on a tributary of the Meghna-GANGES river system and was founded by the Hindu Sena kings in the 7th century C.E. After a Delhi-based Muslim Sultan's conquest of Bengal, Dhaka remained a regional capital between 1203 to 1764. After the British conquest of Bengal in 1757, Dhaka became a secondary capital as Kolkata (Calcutta) became the capital of both Bengal and British India. As a result of the partition of South Asia in 1947, the present-day Bangladesh became a province of PAKISTAN (from 1947 to 1971) and Dhaka again was relegated to a provincial capital.

National capital status in 1971 turned Dhaka into a fast-growing dynamic metropolis. From a population base of 104,000 in 1901, and 239,000 in 1941, Dhaka has grown to 12.5 million in 2000, making it the primate city of the country, and 9th most populous metropolis of the world. The very congested and badly maintained old city, heart of the commercial center, has given rise to a typical traditional bazaar city center. Dhaka is one of the most homogeneous cities, as 95 percent of its population speak Bengali and 90 percent are Muslims.

Because of their number, Dhaka is designated as the City of Mosques. Its long history bears architectural imprints from Hindu, Muslim, British, and post-independence periods. A third of modern Dhaka's population live in dire poverty and in slums, though the rich have built buildings of brick and mortar. Dhaka's problems are many: A preponderance of mosquitoes, high level of noise pollution, flooding after heavy rains, jammed streets with three-wheelers, buses, motorbikes, cycle-rickshaws, and pedestrians.

Dhaka prepared a metropolitan plan in 1995 based on a modern approach. This plan addressed "residential provisions of middle and upper income groups, industrial and commercial development and intra-city transportation." The proposed flood abatement efforts include construction of huge retention ponds on the eastern and western fringes of the city. The problem of enacting the plan is a lack of funding.

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## diffusion

DIFFUSION IS the spread of a phenomenon, such as an idea, a technological innovation, or a disease, over space and time. The origins of interest in diffusion in geography can be traced back to the work of the German geographer Frederick Ratzel (1844–1904). In the second volume of his highly influential *Anthropogeographie*, Ratzel described the diffusion of cultural traits. This work laid the foundation for the studies by geographers on cultural history, which came to be most influential in the work of Carl SAUER (1889–1975) and the geography department at the University of California, Berkeley, from the 1930s through the 1950s, which is referred to as the Berkeley School.

Sauer (1952) argued that issues of cultural diffusion should be one of the main concerns of geography. Sauer believed that the diffusion of ideas, such as agriculture, from "cultural hearths" (cultural centers) has been one of the main driving forces in human history. The research undertaken by the Berkeley School also influenced the study of the origin and spread of culture in the 1960s and, more recently, the study of environmentalism and the processes of cultural globalization.

Another key geographer in ideas of diffusion was the Swede Torsten Hägarstrand (1916–2004). His 1952 doctoral dissertation on innovation diffusion as a spatial process had limited impact until its publication in English in 1967. Hägarstrand observed that the diffusion process can be likened to a wave pattern that loses its strength as it moves away from its source of origin.

Hägarstrand provided a mathematical basis for simulating innovation diffusion on the basis of probability although it is rare for diffusion to be completely random. Each location is regarded as having a different set of probabilities for diffusion based on a mean information field that structures the way in which diffusion flows through a region. Four different types of diffusion are usually recognized.

In expansion diffusion (also referred to as contagious diffusion), a phenomenon, such as knowledge of

an innovation or a disease, is spread by direct contact or word of mouth. This type of diffusion exhibits the frictional effects of distance by which those furthest away are less likely to receive this information than those closer to the initial source (distance decay).

A more developed model of the simple epidemic model of contagious diffusion in which all members of a population are regarded as susceptible to a disease is the General Epidemic Model. In this approach a three-fold division of the population is made into susceptibles, infectives and removals (infectives who after a period of time either cease to pass a disease on to others or communicate information regarding an innovation). The General Epidemic Model has been utilized to study a number of different types of diffusion with respect to disease and the dispersal of plants and animals and has also been refined to introduce greater complexity into studying transmission.

The third type of diffusion is termed hierarchical. In this case diffusion can leap over intervening people and places. Hierarchical diffusion helps explain diffusion within large bureaucratic systems such as multinational firms. It is also a useful way to explain diffusion in the fashion industry, where innovations may originate in fashion centers such as PARIS, NEW YORK, or Melbourne, then diffuse to chain stores in larger cities and from there to retail stores in smaller towns.

The fourth type of diffusion is relocation. In relocation diffusion, information (or plants and animals) moves along with the people who know it. Once relocated, migrants will often then spread innovations via an expansion diffusion process. Indeed, the different types of diffusion are usually occurring almost simultaneously.

Absolute or absorbing barriers are a feature or condition that completely prevent diffusion, for example, mountain ranges that prevent population dispersal. However, over time barriers may become permeable because of technological advances or changes in perception, such as the Appalachians with respect to European settlement in the United States. Finally, there are reflective barriers that deflect an innovation wave back on itself, such as in the case of human settlement on a coastline.

Substantial research continues to be done on diffusion in geography with respect to innovation particularly with respect to technology and products. In this there is a strong relationship to research on time geography as well as trying to understand the social processes behind individual adoption and resistance to adoption.

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## direction

**DIRECTION IS DEFINED** as the line or course on which something is moving, or at which it is aimed to move, or toward which something is pointing or facing. Direction is commonly referenced as an angle made by a given line with an axis of reference, that is up, down, right, left, and so on. With geographic direction, the reference system employed is usually the latitude-longitude coordinate system with meridians converging on the North and South Poles and lines of latitude running parallel to the equator.

The compass rose is the most common graphical representation of the directional angles referenced to the LATITUDE-longitude coordinate system. The compass rose has appeared on maps since the 1300s and it was originally intended to represent the directions of the winds. The compass rose gradually became the standard representation for expressing the orientation of maps and the directions on those maps. The compass rose comprises several sets of directional cues, and each of these has an associated angle, starting with north and increasing in a clockwise direction. First among these cues are the four cardinal directions—north, south, east, and west—with north having an angular measure of 0 degrees, east represented as 90 degrees, south as 180 degrees, and finally west as 270 degrees.

The second set of directional cues is known as the primary intercardinal points, which are (in clockwise order) northeast, southeast, southwest, and northwest. The associated angles for these points are 45, 135, 225, and 315 degrees, respectively. Primary cardinal points are always named with north or south first, then with east or west depending on which two points are bisected. Lastly, the set of secondary intercardinal points (north-northeast, east-northeast, east-southeast, south-



southeast, south-southwest, west-southwest, west-northwest, and north-northwest) bisects the cardinal directions and the primary intercardinal points. Secondary intercardinal points are always named by the nearest cardinal point first, then with the nearest primary intercardinal point. When angles are used to specify direction, this is termed the *azimuth system of direction*, and when cardinal and intercardinal points are used, this is termed the *bearing system of direction*.

With the acceptance of the compass rose and its associated angles as a standardized means of specifying direction, interest turned to determining direction from a point (or between points) on the earth's surface. There are numerous ways to determine direction including using shadow measurements of the sun to determine the north-south line, recording the position of the setting sun on the vernal and autumnal equinoxes (due west), locating the star Polaris (North Star), which is within 1 degree of the North Pole, or similarly using the Southern Cross in the Southern Hemisphere, and using a nautical almanac that records celestial positions for every hour of the year, among other methods. When in the field, a magnetic compass is most often used for determining direction relative to magnetic north. Magnetic north and geographic (or true) north differ slightly, and therefore navigation based on a magnetic compass must correct for this variation. This can be done with the aid of a map that includes a declination diagram illustrating the local difference between magnetic and true north.

One of the distortions caused by projecting a curved surface (the Earth) onto a flat surface (a printed map), is a distortion of directions. If the purpose of the map is to aid in the determination of direction, a map PROJECTION that preserves this property must be chosen.

The problem of finding accurate directions is clearly of great importance in navigation, but direction can play an important role in social processes as well. As one example, consider that many religions have historically placed importance on the direction of prayer. If a worshipper wishes to face toward a particular place (such as Mecca in Islamic religious tradition) this direction should be determined by using a map that preserves direction between Mecca and the location of the worshipper.

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## distance

EMPLOYING THE GEOGRAPHIC sense of the term, *distance* can be defined as the amount of separation between two points or objects on the surface of the Earth. Geographic distance is usually expressed as a linear measurement between locations using one of several commonly accepted metrics (a metric is a standard of measurement using associated units).

Historical distance metrics were often based on the lengths of human body parts. Among these was the cubit, defined as the distance from the tip of the elbow to the end of the middle finger, and the foot (whose corporal association is obvious). These measuring instruments were extraordinarily useful in that they were always available and could not be misplaced. Unfortunately such metrics differed based on the size of person making the measurements, sometimes by several inches or more.

Although attempts at standardizing distance metrics have appeared throughout history, only a few have persisted in wide use to the present day. One of these originated with King Edward I of England when he commissioned the Iron Ulna, or master yardstick, in the early 14th century. One-third of the yard was decreed to be a foot, and one-36th was termed the inch. This system of linear measurement has persisted as two related systems: the British Imperial System and the U.S. Customary System. In the U.S. Customary System the yard is the base unit while a rod equals 5.5 yards, a furlong equals 220 yards, and a mile equals 1,760 yards. The distances related to the depth of bodies of water are often given in fathoms, each fathom being equivalent to 2 yards. The UNITED STATES is the only major country widely employing this system for linear measurement, and efforts have been made to replace it with the more widely accepted metric system.

The metric system became standardized in the late 18th century in France when several proposals were made for defining the standard length of a meter. The successful proposal used the size of the Earth as the ultimate standard of measurement. More specifically, a meter was defined as one ten-millionth of the distance

between the North Pole and the equator along a meridian traveling through Paris. Although error associated with making this measurement (due to miscalculations of the shape of the Earth) resulted in the standard meter being slightly shorter than it ought to be given its definition, this distance became the standard nevertheless. A prototype bar of platinum-iridium was constructed as the standard meter and was kept at standard atmospheric pressure to avoid changes in its length. A subsequent definition of the meter was made based on the length of the path traveled by light in a vacuum over a very small fraction of a second. With the meter established as the basis for the metric system of linear measurement other units were computed as decimal ratios of the meter. The metric system is now the most widely used system of measurement and is more accurately termed the International System of Units (SI).

Given that there are several well-accepted units for linear measure, one can use these metrics to determine geographic distances. In many cases, a geographic distance to be measured is small enough that the curvature of the earth does not alter the measurement within the precision capabilities of the measuring instruments being used.

When this is true, one can assume that the surface on which the measurement is being made is a plane, and the calculation of distance between two points can be made using the Pythagorean theorem. ( $a^2 + b^2 = c^2$ ) where  $a$  and  $b$  are the lengths of two sides of a right triangle, and  $c$  is the length of the hypotenuse of that triangle. If the two points are given by pairs of coordinates ( $x_1, y_1$ ) and ( $x_2, y_2$ ), then  $a^2 = (x_1 - x_2)^2$  and  $b^2 = (y_1 - y_2)^2$ . Solving for the value of  $c$  allows one to calculate the straight line distance between the two points across the plane.

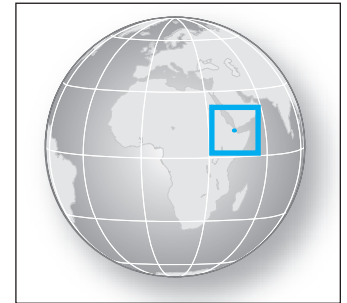
When longer distances across the surface of the earth are being measured, one must compute the spherical distance between the locations. Spherical distance calculations consider that the distances across the surface of a curved object (like the Earth) are longer than the planar distance between points.

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## Djibouti

**Map Page** 1114 **Area** 8,958 square mi (23,000 square km) **Population** 457,130 (2003) **Capital** Djibouti **Highest Point** Musa Ali 6,653 ft (2,028 m) **Lowest Point** -550 ft (-168 m) **GDP per capita** \$1,400 **Primary Natural Resources** negligible.



BORDERED BY ETHIOPIA, ERITREA, and SOMALIA in Africa, the country of Djibouti (the former French Somaliland and then AFARS and Issas) is the epitome of a geopolitical state. It is a state that has been created and defined by its geographic location. Similar to GIBRALTAR and Aden, Djibouti controls access and egress from a major waterway: the Suez Canal and RED SEA. From 1862, Djibouti was controlled by the French, especially the French Foreign Legion, until 1977. In 2002, the UNITED STATES established a military base here. Were it not for its geopolitical value, there would be no economy beyond herding of goats and no political unit.

Small in area, with some features such as Lake Assal below sea level (550 ft or 168 m), Djibouti is arid and occupied primarily by pastoralists and refugees from the war between Ethiopia and Eritrea. Its deep harbor and the fact that all traffic to and from the Suez Canal (and thus Mediterranean Europe) must pass its location has made the area important far beyond any local resources—of which there virtually are none to speak of.

The only natural resource, other than its location, is the salt deposit at Lake Assal. However, salt is more easily and cheaply obtained in many other areas. The closest local parallel to the geopolitical value of Djibouti would be Aden, which also controls access to the BAB AL MANDEB, Red Sea and Suez Canal, but Aden was controlled by the British.

Djibouti also is located on a major fault (fracture) zone known as AFAR (for Africa/Arabia), where major geologic plates are separating and rotating, making it an extremely active earthquake and volcanic area as well.

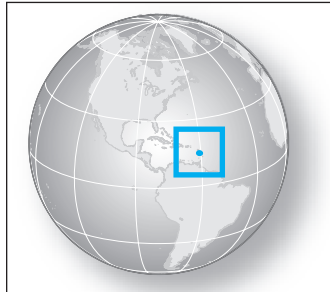
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## Dominica

**Map Page** 1137 **Area** 294 square mi (754 square km) **Population** 69,655 **Capital** Roseau **Highest Point** Morne Diablatins 4,775 ft (1,447 m) **Lowest Point** 0 m **GDP per capita** \$5,400 **Primary Natural Resources** timber, hydropower.



THE LAST OF THE islands of the West Indies to be colonized, chiefly because of the fierce resistance of the native Carib population, the island of Dominica now retains the only pre-Columbian population in the eastern CARIBBEAN SEA. Dominica also maintains more of its original tropical vegetation, due to the roughness of its terrain—it is 66 percent forested, compared to 36 percent on SAINT VINCENT, and only 9 percent on GRENADA. The inability to establish large plantations thus served to preserve Dominica's natural riches, a fact that is now a blessing to the country's economy as a chief draw for tourism, supplemented by reserves of timber for export.

As with the other islands in the Windward group of the Antilles, Dominica is volcanic in origin. Morne Diablatins is the island's highest volcanic peak, but there is also considerable thermal activity and a large crater lake located only 7 mi (11 km) from the capital city of Roseau. The Caribs (approximately 3,000 in number) live mostly in a reservation set up for them in the northeastern part of the island. Many still farm small plots and are involved in weaving traditional baskets used all over the island and sold to tourists. Having richer and more luxuriant soil than its neighbors, Dominica grows most tropical products with ease but specializes in limes.

The island, named by Christopher Columbus on Sunday (Domingo), November 3, 1493, lies between the French departments of GUADELOUPE and MARTINIQUE and was itself a French colony until 1763. Among those many North American and Caribbean

territories reassigned to the British by the Treaty of Paris, Dominica remained a British colony until independence in 1978.

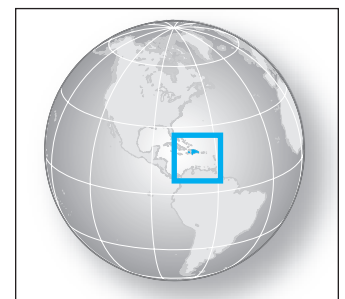
Because of Carib resistance and the steepness of its volcanic slopes, Dominica was not developed as a major sugar producer like its neighbors. Small farmers continued to live much as they had done before the British takeover, and the island retains much of its French flavor, especially in its patois. Possibly as a result of this duality of loyalties, Dominica has chosen to become a republic while remaining a member of the British Commonwealth—in other words, unlike ANTIGUA or SAINT KITTS, the chief executive of Dominica is an elected president, not the hereditary British monarch. With one of the lowest per capita incomes in the Lesser Antilles, the population is increasingly young and urban, with nearly a third living in the capital of Roseau.

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## Dominican Republic

**Map Page** 1137 **Area** 20,729 square mi (48,730 square km) **Population** 8,715,602 **Capital** Santo Domingo **Highest Point** 10,416 ft (3,175 m) **Lowest Point** 151 ft (46 m) **GDP per capita** \$6,300 (2002) **Primary Natural Resources** nickel, gold, silver.



THE DOMINICAN REPUBLIC, which sits on the western portion of the island of Hispaniola in the CARIBBEAN SEA, was once covered with lush rainforests full of thousands of flora and fauna species throughout its steep mountains and deep valleys. However, this country has faced hundreds of years of deforestation, and many of the swamps were drained. Because of its

tropical maritime climate, frequent rainstorms send topsoil into the ocean, and a barren landscape has been created. The top soil deposits in the ocean have also destroyed marine coral reefs. But portions of the countryside have retained their beauty with different trees and over 218 bird species. In the surrounding waters, humpback whales gather, and sea turtles, manatees, and pilot whales dominate the marine life.

The island of Hispaniola was founded by Christopher Columbus in 1492 and ultimately became a permanent Spanish settlement. After years of oppression and unrest, an independent Dominican Republic was created in 1844. For 25 years after independence, the Dominican Republic was ravaged in a leadership conflict between General Pedro Santana and General Buenaventura Báez and their armies. In 1882, General Ulysses Heureux rose to power and, until his assassination in 1899, mismanaged the nation's affairs. He violently repressed any opponents and poorly managed the economy. By the end of the 19th century, the Dominican Republic's economy had progressed to an agriculturally driven one. Tobacco and coffee became two of the main crops.

After Heureux's death, the sugar industry was revived and American businessmen began to invest in the plantations. In 1916, U.S. military forces were sent to the Dominican Republic. For eight years, these forces occupied the country, disbanded the Dominican army, and remodeled the legal system. The military also trained local militias. By 1924, the American military had left the Dominican Republic with Raphael Leonidas Trujillo in charge of the army. Six years later, Trujillo gained complete power of the government.

Trujillo enforced a very repressive dictatorship. His followers wreaked havoc against political opponents, even reverting to assassinations. However, he maintained positive relations with the UNITED STATES, by offering favorable conditions to American companies, and not supporting communism. However, in the 1950s, Trujillo's power base slowly began to crumble, and his relations with the United States suffered. One year after being connected to an assassination attempt against the Venezuelan president, Trujillo himself was assassinated. For the following four years, the Dominican Republic teetered on the edge of a socialist state.

In 1965, President Lyndon B. Johnson called on the U.S. military to once again enter the country, and restore order. One year later, Dr. Joachim Ballaguer, a former Trujillo lieutenant, was elected president in an allegedly corrupt election. He remained in power for 12 years, and then after a tumultuous election was re-

placed by Antonio Guzmán of the Dominican Revolutionary Party.

In 1982, Guzmán committed suicide and was replaced by Salvadore Blanco. However, corruption led to his downfall and eventual imprisonment. Ballaguer was again voted in to office in 1986. A public works reconstruction program was implemented, but by 1988, the country suffered a two-year recession. In June 1989, massive demonstrations were held in protest of the economic difficulties and lack of basic resources such as water and electricity.

Balaguer instituted a second series of economic reforms, which included balancing the budget and limiting inflation. These measures were overall successful, and economic growth continued through the decade. In June 1996, Leonel Fernandez Reyna was elected president. He continued the economic reforms but was not reelected in 2000. Hipólito Mejía from the Revolutionary Democratic Party was voted in as president. The economic reforms continue in the country and the country is slowly beginning to prosper.

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## domino theory

THE DOMINO THEORY states that if one vital country in a region falls to an expansionist negative philosophy, then other countries in the region similarly situated and similarly structured would fall victim to the same philosophy, either through force or through influence of example. In its pure form, the negative philosophy is communism but in variants it can be socialism or theocratic Islam. The theory was used as a rationale for American interventions, including most disastrously the intervention in the Vietnam War.

After World War II, the geopolitical situation of an already shaky alliance between the Western capitalist democracies and the communist Union of Soviet Socialist Republics fell apart as the Soviets sought to establish a buffer zone of satellite states and the UNITED



STATES asserted the rights of all nations to independence in a postcolonial world. Each side accused the other of starting the Cold War, and the world quickly polarized as each camp took an “either against us or with us” attitude and enforced it through alliances, such as the Soviet bloc Warsaw Pact and the U.S.-led NORTH ATLANTIC TREATY ORGANIZATION (NATO). Battling monoliths faced each other across the Iron Curtain in a Cold War where none was allowed to be neutral.

The West definitely feared communism, as it had since the Russian Revolution had generated Red Berlin and America’s red scare back in the aftermath of World War I. The communists had been active in the intervening years, notably in SPAIN, and there were examples where briefly democratic countries became communist as the map of Europe turned “red” after World War II. The U.S. consensus was that all communist movements were part of the communist international, puppets of the Kremlin. Communism was a monolith, not an idea, like democracy, that might arise in a nation independently of either the United States or the Soviet Union.

Because the Soviets had managed to acquire territorial control in East GERMANY, POLAND, CZECHOSLOVAKIA, ROMANIA, and BULGARIA and because communists were in power in Yugoslavia and CHINA, the United States perceived the other side as a monolith united into a single bullet aimed at the Western heart. RUSSIA had been toppling dominoes from the first day after the gunfire of World War II stopped. The only alternative was to contain communism where it existed and keep it from entering any other territory, be it free or non-aligned (a shaky category of potential candidates for coming under the American umbrella).

Presidents Harry Truman and Dwight Eisenhower both subscribed to the idea that the only way to confront Russia was to keep it penned where it was. The successful prevention of the Greek domino’s fall was validation. In 1947, GREECE was at risk, with communists in position to take another country into the opposing camp. American involvement halted the collapse, saving Greece for the West. That was containment.

According to the theorists, containment of communism outside of Greece kept neighboring TURKEY from falling into the Soviet sphere. Had Turkey fallen, then the Soviets would be able to influence the MIDDLE EAST, with Asia next. A corollary to containment was the domino theory.

Liberal and conservative alike in an age of consensus about the evils of communism subscribed to the

domino theory. They agreed that if the communists ever managed to take one country, then that country’s neighbors would fall one by one until none was left to the free world. This communist imperialism was what President Eisenhower referred to in April 1954 when discussing Indochina and the domino theory.

In response to a question from Robert Richards from Copley Press about the strategic importance of Indochina to the free world, Eisenhower replied that the region had a significant value as producer of raw materials the free world needed—tin, tungsten, and rubber. Also, it was undesirable to have another population fall under a dictatorship after the loss of 450 million already. Most important, there was the “falling domino” principle. Set a row of dominoes up properly, touch the first one, and watch them fall one by one until none is left standing. Even the last one is toppled. Lose Indochina, and next would be Burma, THAILAND, the Malay Peninsula, and INDONESIA. Eisenhower further explained that these losses would alter the defensive geography of the region. Not only would JAPAN, TAIWAN, and the PHILIPPINES be vulnerable, but so would AUSTRALIA and NEW ZEALAND. It would also put pressure on Japan, having lost its commercial sphere, to turn toward the newly communized countries.

The domino theory was the rationale for U.S. support for colonialist FRANCE and later dictatorial governments of South VIETNAM in Indochina against what it read as a communist insurgency compounded by a communist invasion. In a 1963 press conference, President John Kennedy expanded the domino theory to LAOS. He explained that Laos, a country of 2 million, was a sovereign state whose people desired to be independent. It also had a strategically vital border on the MEKONG RIVER. If it were to go communist, it would imperil the northern frontier of Thailand, would increase pressure on CAMBODIA, and would increase pressure on Vietnam, which would increase pressure on Malaya. The other side understood the domino theory and would possibly seek to take advantage of the vulnerable dominoes one after the other. It was vital to uphold the Geneva Accords, to protect the dominoes to preserve the stability of Southeast Asia.

The theory acquired critics over time, but it remained the majority view as the United States entered deeper and deeper into the war in Indochina: Vietnam, Laos, Cambodia. From Eisenhower’s blocking of the elections in Vietnam when he expected the communists to win, to Kennedy’s sending of “advisors,” to Johnson’s escalation until well over half a million American troops were fighting to save the South Vietnamese

domino, to Richard Nixon's secret plan for peace, the domino theory kept the U.S. in Vietnam. For more than a decade the dominoes held. Then the United States retreated, leaving Vietnam to solve its problems alone. The south went communist.

After the Democratic Republic of Vietnam came into being as the unified successor to the divided country, in 1975 Laos and Cambodia also became communist. This apparent falling of dominoes to the communists validated the theory for some. Those who denied the legitimacy of the domino theory argued that the examples were not valid, because North Vietnam had long dominated Laos and that the "domino" had already fallen. In Cambodia the Khmer Rouge regarded Vietnam as an enemy. Although they shared a loose philosophical tie, there was no monolithic communism there. If anything, there was a potential fracture in the monolith, a counterforce to the dominant communist power, as China and Yugoslavia had been for the Soviet Union.

President Richard Nixon's perspective was that the most compelling argument for the theory was that the dominoes had faith in it. It's true that countries bordering communist ones did fear subversion. That was one of the justifications for the treaty system: mutual protection of the potentially endangered dominoes.

A variant on the domino theory espoused by Noam Chomsky is that the capitalists feared a successful unaligned socialist state because it would provide an example of an alternative path to the communist or capitalist ones. It would cause others to fall like dominoes into the socialist neutralist pattern. Chomsky cites this fear as the primary reason that the United States intervenes in politically and strategically insignificant parts of the world such as GUATEMALA, ANGOLA, and EAST TIMOR. The counter to this theory is that it fails to fully account for Soviet influence in the third world.

Although few of the original supporters of the theory still subscribe to it, some still justify military activism using the domino theory. Rather than communism, in the post-Cold War world, the threat is Islamic theocracy and the counterweight is liberal democracy in the Middle East. The theory applied during the Iran-Iraq War as a rationale for taking the side of IRAQ in order to prevent IRAN from spreading its radical theocracy in the Middle East. The neoconservative rationale for invading Iraq in 2003 was that toppling Saddam Hussein would create a model liberal democracy that would spread the same system through a tumbling of repressive autocratic regimes from Iran to SAUDI ARABIA, perhaps throughout the Muslim world.

And there remain those who believe that the Vietnam War validated the theory. According to this logic, the countries of the Association of Southeast Asian Nations (Philippines, Indonesia, MALAYSIA, SINGAPORE, and Thailand) were free because the United States gave them the example that it would support regimes that resisted communism. The Indonesians evicted the Soviets in 1966 because the United States was fighting for freedom, theirs included, in Vietnam. That resistance halted an inevitable advance of communism to the Malacca Straits and Singapore.

Another domino theory deals with the postwar spread of democracies. In the late 1990s there were 179 democracies of 192 sovereign states, 93 percent of the world's governments. Sixty-nine nations had their first-ever elections in that decade. Three of the five newest democracies were former Soviet republics (BELARUS, ARMENIA, and KYRGYZSTAN), all of which had national elections in 1995. In Africa, TANZANIA and GUINEA joined the roster of new democratic countries the same year.

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## Don River

THE DON RIVER IS one of RUSSIA's major commercial rivers, which, connected to the VOLGA through the 65-mi (105-km) Volga-Don Canal, allows river traffic to sail from Russia's interior ports as far inland as MOSCOW to ports on the BLACK SEA and beyond to the MEDITERRANEAN. The Don River basin also includes its most important tributary, the Donets, which flows through the northeastern corner of the UKRAINE, the most industrially active region of that country, known

for its coal and production of steel and heavy manufacturing machinery.

The Don rises near the city of Tula, about 125 mi (200 km) southeast of Moscow. It then flows for 1,220 mi (1,950 km), first southeast to a bend a few kilometers west of Volgograd (coming within 31 mi or 50 km of the Volga River), then southwest to its mouth on the Sea of Azov. It is at this bend where the rivers Don and Volga are joined by the Volga-Don Canal, built in 1952. The canal joins the Don in the Tsimlyanskoye Reservoir, one of Russia's numerous vast hydroelectric projects built in the Soviet era, with a large dam between the towns of Tsimlyansk and Volgograd.

The Don basin's largest cities are clustered below this point (Rostov, Bataysk, Novocherkassk) or along the industrial Donets basin in Ukraine (Kharkov, Lisichansk, Lugansk). Altogether, the Don basin drains 178,894 square mi (458,703 square km), most of it Russia's breadbasket (83 percent is cropland).

Known as the Tanais to ancient geographers, it was the center of Scythian culture in the centuries before and after the Christian era. It is the busiest trade river of south Russia, navigable for 800 mi (1,290 km), bringing Siberian raw materials and manufactured goods from the north to the warm-water ports of the south. Frozen during three months of the year, it is also occasionally hampered by severe spring flooding, but also large volumes of silt that make navigation in its lower reaches treacherous because of shifting sandbanks and shallows. Its entryway into the Sea of Azov, the Gulf of Taganrog, is one of the shallowest bodies of water in the world, with depths averaging a mere 3.3 ft (1 m).

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## Drakensberg Mountains

THE DRAKENSBERG Mountains form one of the most scenic natural areas in SOUTH AFRICA. The mountain range straddles the eastern border of LESOTHO, a LANDLOCKED nation lying within the boundaries of South Africa, located about 150 mi (250 km) north-



*Sentinel Peak typifies the rugged terrain of the Drakensberg Mountains in South Africa and Lesotho.*

west of Durban. The name *Drakensberg* means “Dragon Mountains” in Afrikaans. The range is also known to the Zulu nation as “uKhahlamba” (the “Barrier of Spears”).

The Drakensberg Mountains are the southern extension of the interior highlands of Africa, rising to 10,826 ft (3,300 m) before dropping to the coastal lowlands near Durban. The Drakensbergs serve as the headwaters of South Africa's largest river, the Orange River, which flows west from the highlands of Lesotho to the South Africa-NAMIBIA border before emptying into the ATLANTIC OCEAN. The steep gradients and land use cause many of South Africa's rivers to have a high rate of runoff and soil EROSION.

Seasonality is reflected in dry, sunny winters (April to October) and summer rains (November to March). Rainfall varies from 15.7 in (40 cm) to 35.4 in (90 cm) of precipitation per year, with some areas occasionally receiving up to 78.7 in (200 cm) per year. A “rainfall line” denotes grazing and irrigated crops to the west and land more suitable for farming to the east. Record snowfalls (19.7 in or 50 cm) occurred in July 1994.

Bushmen (called “San”) have inhabited the basalt ESCARPMENT from thousands of years ago up until the late 1800s, leaving tens of thousands of rock paintings at over 500 sites. This is a major reason part of the mountain range was designated the uKhahlamba-Drakensberg World Heritage Site in 2000 by the United Nations.



The Drakensberg Mountains also hold numerous national parks, the most scenic of which is Royal Natal National Park, located at the northern end of the range. Here lies the Amphitheatre, a natural ring of thousand-meter high cliffs that includes multilevel Thukela Falls, the second-highest waterfall in the world.

In addition to cultural and scenic amenities, the Drakensberg Mountains also harbor high levels of biodiversity, much of this resulting from the steep elevation gradients. Ninety-eight of 2,153 plant species are endemic or near-endemic to the area; the almost 300 bird species include the globally endangered cape parrot and white-winged fluff-tail.

Despite efforts by Zulu kings to limit the range of trophy hunters, several wildlife species nearly became extinct from hunting here by the late 1800s. The eland, endemic gray rhebok, and clawless and spotted-neck otters are species populations exhibiting healthy recovery from this historic setback. Other traditional African wildlife that inhabit the Drakensberg Mountains include leopard, baboon, jackal, wildebeest, and zebra.

Historic battlefields dot the region, marking sites of the British-Zulu wars and British-Boer wars of the 1800s. Nearby towns and cities include Ladysmith, through which Mahatma Gandhi and Winston Churchill passed early in their careers. Ladysmith is the home of Ladysmith Black Mambazo, a musical group popularized globally by Paul Simon.

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## dunes

DUNES ARE PILES of windblown sediment. Geomorphologists refer to dunes and other wind-created features as aeolian landforms. (Aeolus was the ancient

Greek god of the winds.) Geomorphologists also refer to dunes as sand dunes, as sand is the most common type of sediment in the deposits. Dunes sometimes include sand-size aggregates of clay, gypsum, or carbonate grains as well.

Dunes form when an obstacle (a low hill, rocky outcrop, cluster of bushes or grasses, etc.) slows down sediment-laden wind. Dune development requires a sediment source and a relatively strong wind. Sand dunes form in deserts and along low coastlines. In deserts, winds blowing across dry deflation-prone surfaces supply the sand. Coastal dunes depend on long-shore ocean currents to bring sand to beaches, and then steady winds blow the sand inland where the dunes form. In profile view, most dunes consist of three parts: a gently sloping (upwind) back slope, a sharp-edged or slightly rounded crest, and a steeply inclined (downwind) slip face.

Winds blow up the back slope side of the dune to the crest, crossing the crest at a 90 degree angle. Active dunes slowly migrate downwind as the winds push the sand-size particles up the back slope to the crest, where they slide down the slip face. Large dunes travel a few dozen feet or meters a year; smaller ones move up to 131 ft (40 m) a year. Active dunes quickly smother any vegetation that manages to take root on their surfaces.

Stabilized dunes are dunes anchored in place by deeply rooted vegetation. Dune stabilization occurs in semiarid and coastal areas where the climate is moist enough for grasses or small bushes to grow on the dunes. Precipitation and dew dampen the sandy surface to make it less mobile and less apt to smother developing vegetation growth. In some regions, climate change from a desert to a more humid climate or a reduction in sand supply accounts for dune stabilization. Anchorage may also be human-induced. Cultivating fast-growing grasses on dunes is one method; people plant the grasses to slow down dune migrations into agricultural fields and check sand from blowing into cities and towns. Artificial dune stabilization is usually only a temporary fix to an inexorable natural process of dune migration.

The most common dunes are barchan, transverse, seif, star, and parabolic dunes. The barchan is small dune that migrates across a surface that has little sand. It is crescent- or U-shaped, with narrow tips pointing down wind. Transverse dunes are only slightly crescent-shaped, and they occur where there is an abundant supply of sand. Transverse dunes often form fields of wavelike sand dunes whose slip faces consistently face the same direction. Seif dunes form in a generally



parallel arrangement. *Seif* is the Arabic word meaning “sword,” an apt expression for this long narrow dune. Seif dunes can be tens of kilometers in length and several tens of meters high. Seifs have multifaceted slip faces, as variable wind directions affect them. The changeable winds cause the dunes to migrate in the direction of their longitudinal axes.

For this reason, geomorphologists refer to seifs as longitudinal dunes. Variable winds cause star dunes to have even more complex slip faces than longitudinal dunes: star dunes have central peaks from which several crests (arms) radiate. Coastal dunes are usually of the parabolic type as sea breezes imprint a subtle parabola (bowl) shape on the dunes’ back slopes. This

depression gives the parabolic dune a U-shape plan in which the arms point upwind. Winds from powerful storms that form over the ocean sometimes accentuate parabolic depressions by creating blowouts—dunes with very deep excavations in their back slopes.

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## earthquakes

**STRONG GROUND** motion occurs whenever energy, conserved as strain in the Earth's crust or upper mantle, is released instantaneously. In such an event, commonly called an earthquake, energy radiates from the source of release in a series of waves. As waves propagate through rock and other elastic media, they cause periodic displacements (movements up and down or back and forth) that are experienced as shaking. While the vast majority of earthquakes, or seismic events, release too little energy or occur at too great a distance to cause this experience, a small percentage are perceived as shaking. A smaller number still can cause damage, death, and devastation. Energy transferred through the impact of extraterrestrial bodies, such as meteorites, and from detonations of explosive materials can also cause strong ground motion. In most cases, the energy so released is too slight to effect more than a small area.

### NATURALLY OCCURRING EARTHQUAKES

The crust of the Earth is in constant motion as new rock, formed when magma rises to the surface of the crust, displaces older crustal rock. To complete a cycle, older rock returns to the Earth's mantle, replenishing sources of magma. One can imagine a perfect geometry for the Earth's surface that might accommodate this

process without strain—it would resemble the mechanics of an escalator. But the real surface of the Earth, which is spheroidal, is far less than ideal. The creation of new rock requires constant readjustment of the spheroidal surface. Taken together, these processes of creating of new rock, the destruction of older rock, and the readjustment of rock on the spheroidal surface are called **PLATE TECTONICS**.

Crust at the Earth's surface is not continuous. The crust is composed of a set of plates, each moving relative to adjacent plates. This movement causes strain wherever movement is impeded or opposed. The resulting strain is expressed in crustal rock as deformation. Deformation is expressed in crustal rocks through several characteristic structures. Folds in the crust are one such structure. Faults—surfaces within the crust that accommodate contrary motions of rock on either side of the surface—are another. While movement along some faults can be nearly continuous, the geometries of other faults can result in discontinuous movement and will store strain. Over time, strain in the rock will increase to a point where the competence of the rock is insufficient to store additional strain. At that point, the fault surface will rupture. The subsequent release of strain in such a rupture is the proximate cause of earthquakes.

The geometries of fault surfaces are numerous and complex. Structural geologists recognize three basic



*An earthquake that struck on July 11, 1927, in Palestine reduced this house in Nablus to a mere ruin.*

fault types. These are the normal fault, the thrust fault, and the strike-slip fault. Normal faults occur where tectonic movement, resulting in vertical displacements of crust, stretches the crust. Thrust faults also displace crust vertically, but along a lower fault angle and as a result of compression rather than tension. In strike-slip faulting, displacements are horizontal. The San Andreas Fault, running from under the Salton Sea to a point north of San Francisco, is a well-known example of a strike-slip fault. All three of these geometries are generalizations; many faults result in both horizontal and vertical displacement. Moreover, earthquakes generally occur within a fault zone, rather than occurring repeatedly along a single fault plane.

When strain is released in the rupture of a fault surface, energy dissipates as mechanical motion expressed as oscillations, or waves. Seismologists, scientists who observe and study ground motion, have found that the waves generated by fault ruptures take several forms, each with distinct properties. Surface waves generate

both vertical and horizontal oscillations at the Earth's surface. Primary (P) and secondary (S) body waves propagate through crust at different velocities. Primary waves propagate through all layers of the earth, but secondary waves do not propagate through fluids and therefore do not pass through the Earth's core. The different properties of waves provide seismologists with a variety of techniques for pinpointing the sources of waves (at a focal point on the fault plane, or focus, and at a point on the surface above, known as the epicenter), the characteristics of fault displacement, and a means for studying the Earth's core and mantle.

Because the crustal rock and sediments at the surface of the Earth are not uniform, wave propagation through the crust is not uniform. Surface waves, which cause most of the damage in earthquakes, exhibit different properties when propagated through different thickness and densities of rock; wave motion can be magnified when surface waves pass through unconsolidated sediments, especially sediments with high ground water content. Often, such sediments experience liquefaction, in which the competence of the sediments is severely diminished. The greatest damage in earthquakes usually occurs in structures built on such sediments, as in the Marina District in San Francisco, which was severely damaged in the Loma Prieta earthquake of 1989.

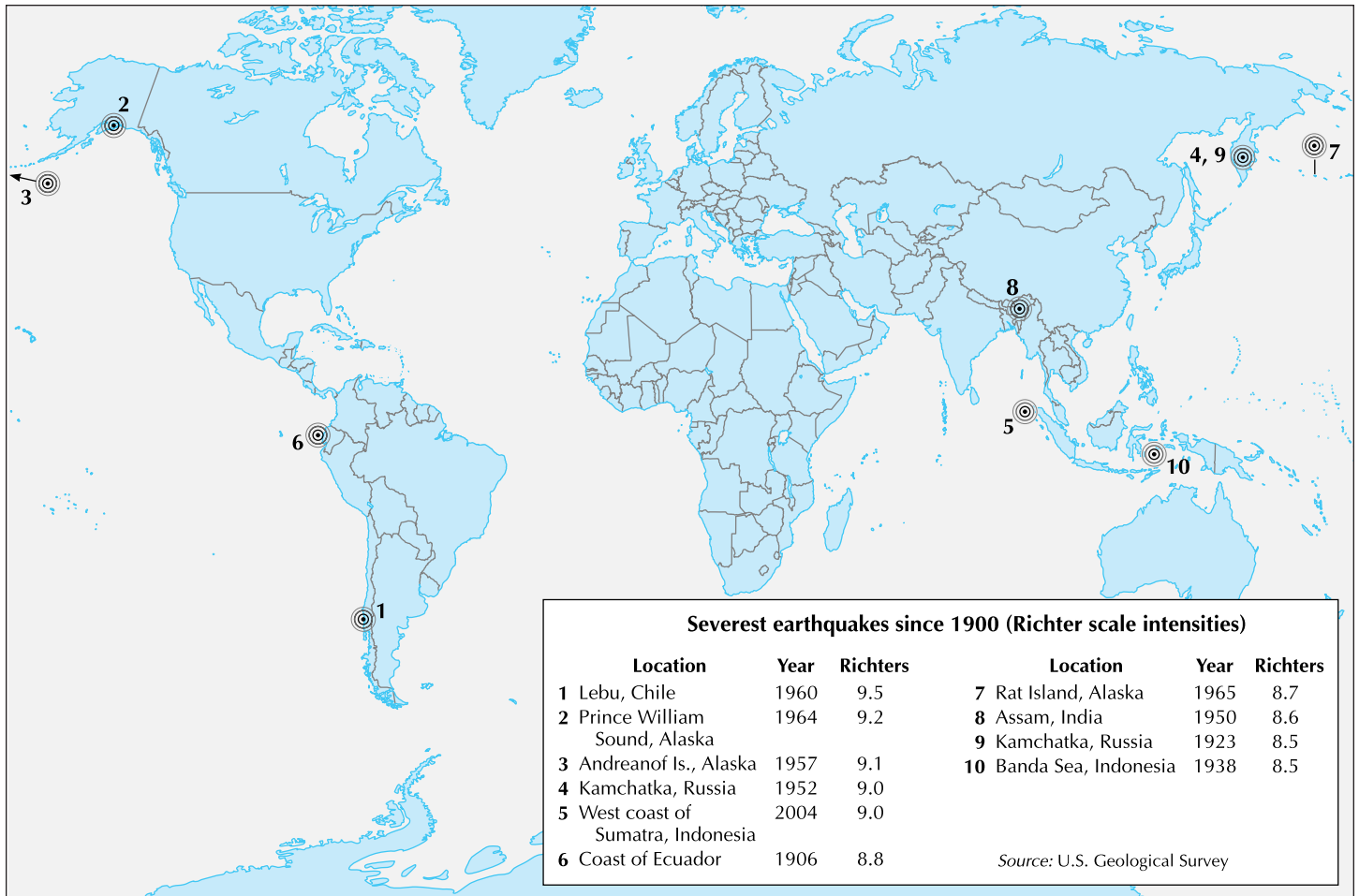
### EFFECTS OF EARTHQUAKES

For most organisms, the effects of earthquakes are minimal compared to the effects of other natural catastrophes such as volcanic eruptions, floods, and large storms. Tall trees growing near a fault may be "topped" by side-to-side motion in an earthquake of sufficient intensity, and domesticated animals have been observed to alter their behavior as a precursor to an earthquake. Liquefaction of soils may cause extensive damage to forests. Nevertheless, the effects to most organisms are benign.

The same cannot be said for most modern human populations in cases of earthquakes of moderate to high magnitude. The Modified Mercalli Scale of earthquake intensity, also known in revised form as the European Macroseismic Scale, attests to the effects that very strong ground motion can have for built environments and the assortment of objects that we create and use.

An earthquake at level V in the 12-level scale, for instance, is "felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop." At level XII, dam-





In the United States, over approximately the past 100 years, large earthquakes have caused extensive damage in San Francisco (1906 and 1989); Anchorage, Alaska (1964); and in the Los Angeles area (1933, 1971, and 1994).

age is “total. Lines of sight and level are distorted. Objects thrown into the air.”

Historically, earthquakes have posed severe challenges for human inhabitations, involving loss of life, destruction of inhabitations and property, and—in some cases—political upheaval. Earthquakes have been recorded throughout human history, and there are records of earthquakes for most great civilizations. The Minoan Civilization on Crete, for example, is believed by many historians to have faltered or collapsed due to earthquakes and tsunamis during the second millennium, B.C.E.

In November 1755, a large earthquake devastated the city of Lisbon, in Portugal, killing 40,000 individuals and destroying most structures. The earthquake was felt throughout the Iberian Peninsula and elsewhere in Europe, and was recorded in a number of contemporary accounts. A fictionalized account of the

earthquake serves as a climactic event in François Marie Arouet Voltaire’s literary work, *Candide*.

Within the contiguous United States, the largest event in recorded history was a cluster of three large earthquakes in 1811 and 1812 centered near New Madrid, MISSOURI. The largest of these, estimated at greater than 8.0 on the Richter scale, occurred in December 1811. The earthquake cluster caused changes in the course of the MISSISSIPPI RIVER and devastated large areas of forest.

Over approximately the past 100 years, large earthquakes have caused extensive damage in San Francisco (1906 and 1989); Anchorage, ALASKA (1964); and in the LOS ANGELES area (1933, 1971, and 1994).

In religious cultures, the causes of earthquakes were generally ascribed to acts of the gods, or of God. The roots of western philosophy, however, looked to secular causes; Aristotle explained earthquakes as

winds trapped and released from subterranean caves. The Chinese developed a rudimentary (but elegant) seismograph. With the scientific revolution and the subsequent Enlightenment, the search for causes of earthquakes increased. But it was the San Francisco earthquake of 1906 that spurred greater concentrations of scientific interest in earthquakes, resulting in the “elastic rebound” theory, devised by H.F. Reid in a report on that earthquake.

In the 1920s, the newly founded California Institute of Technology and its Seismology Laboratory, with a network of seismographs created to monitor and study earthquakes along California’s San Andreas Fault and ancillary faults, became a magnet for seismologists. There, Charles Richter and Beno Gutenberg devised what has become known as the Richter scale, a logarithmic scale of wave motion amplitudes that yields a measure of the magnitude of an earthquake. Also working in the Seismo Lab, Hugo Benioff developed an interest in studying deep focus earthquakes. Results of his studies were important for the later development of plate tectonics; Benioff’s observed patterns of deep-focus earthquakes were later explained in plate tectonics as part of the subduction process.

In the aftermath of the 1964 Anchorage earthquake, policy makers became interested in seismologists’ hopes that earthquakes might be predictable. This interest may have been related to Cold War politics; a science and technology for predicting earthquakes could lead to evacuations and might save many lives, demonstrating the capacity in the United States for surviving a nuclear attack of comparable destructive force. By the 1980s, primary interest in policy shifted from prediction to preparation and mitigation: engineering better buildings and infrastructure, and strengthening building codes.

Interest in earthquake prediction has not abated. In the 1980s, the U.S. Geological Survey created an extensive system of monitoring devices in Parkfield, California, a site of generally dependable movements along the San Andreas Fault. Data collected in the September 28, 2004, earthquake in this location is presently being analyzed for evidence of precursor activities that may someday permit reliable predictions.

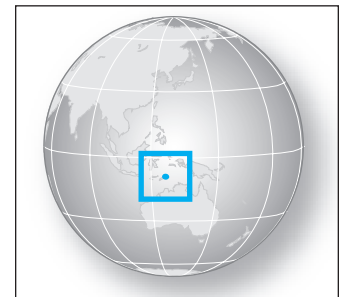
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## East Timor

**Map Page** 1124 **Area** 5,853 square mi (15,007 square km) **Population** 997,853 **Capital** Dili **Highest Point** 9,778 ft (2,963 m) **Lowest Point** 0 m **GDP per capita** \$500 **Primary Natural Resources** gold, petroleum, natural gas, manganese, marble.



THE ISLAND OF Timor, in the Indonesian archipelago, is no stranger to struggle. Disputed between the Dutch and Portuguese since the late 1500s, the island was officially split when the eastern portion declared independence from PORTUGAL in 1975, only to be immediately claimed by INDONESIA, setting off 25 years of violence and destruction.

The Democratic Republic of East Timor (or Timor Leste) forms the eastern half of the island of Timor, the easternmost (and largest) of the Lesser Sunda islands (in fact, “timor” simply means “east” in Malayan languages). The new nation also includes an enclave in the western half of the island (Oecussi-Ambeno), and an island off the northern coast, Ataúro. Timor is located about 620 mi (1,000 km) east of JAVA, and about 300 mi (450 km) northwest of AUSTRALIA. The island is volcanic in origin and its terrain is mostly mountainous, with difficult access due to steep coasts and coral reefs.

Timor thus remained little explored until the later 20th century, and European influence was restricted to a few coastal settlements (mostly on the north coast) dependent on plantations of coffee, rice, sugar, and coconuts. The interior mountains contain considerable minerals, including gold, manganese, and marble, but these are largely unexplored. The discovery of large re-

serves of offshore petroleum and natural gas promises much for the future of the country, but is also a continuing source of tension between rival claims of the Indonesian and Australian governments.

Both Portuguese and Dutch trading posts were established on Timor in the 16th century, but it was not until 1913 that the Dutch formally recognized the Portuguese position in the eastern half of the island. Long after the Dutch East Indies became independent as Indonesia in 1949, the Portuguese colony of Timor declared itself independent in 1975. It was immediately occupied by Indonesia, however, and forced to assimilate with the rest of the island. After 20 years of violence resulting in the loss of between 100,000 and 300,000 lives (killed or missing), a United Nations-supervised referendum in 1999 resulted in renewed independence in May 2002, and East Timor became a new nation in September 2002.

The country's capital, Díli, built by the Portuguese in the 1620s, is located on the northern coast of the island and is being rebuilt after near complete destruction in 1999. At independence, East Timor was one of the world's poorest nations, with 70 percent illiteracy, 12 percent infant mortality, and an average life expectancy below 50 years. The country relies mostly on exports of timber and coffee, while it waits for resolution of its struggles with Australia over exploitation rights of the Timor Gap, the region of seabed off the southeast coast with large fossil fuel reserves. A settlement between Australia and Indonesia was reached over this prize in 1989, when East Timor was still under Indonesian occupation, and Australia is now unwilling to give up concessions to an area potentially yielding \$29 billion in revenues. This conflict remained unresolved in 2004.

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## Easter Island

**POLITICALLY,** EASTER ISLAND has belonged to CHILE since 1888, though it lies some 2,200 mi (3,500



*Anthropologist Thor Heyerdahl proposed Easter Islanders originated in Peru, built a balsa raft, and sailed it to prove the point.*

km) west of the coast of Chile and just south of the TROPIC OF CAPRICORN in the PACIFIC OCEAN. Its nearest neighbor is PITCAIRN ISLAND 1,132 mi (1,819 km) to the west. The major settlement is Hanga Roa. Easter Island enjoys a subtropical climate tempered by oceanic influences; the annual temperature ranges from 86 degrees F (30 degrees C) in January/February to 57 degrees F (14 degrees C) in July and the annual precipitation is 45.2 in (114 cm).

The island has an area of 64 square mi (166 square km) that is triangular in shape and composed of volcanic rocks. There are three extinct volcanic peaks, the highest is Maunga Terevaka at 2,086 ft (652 m) and between which there are gently rolling lava hills. Two of the volcanic peaks have lakes in their craters that are sources of fresh water. Geologically, the island is young, having been formed by volcanic eruption on the Nazca Plate, a crustal "hot spot," in the last 2 to 5 million years. The rocks are andesites and basalts, which have produced alkaline to neutral soils rich in clays and loams. The consolidated volcanic ash, or tuff, in





*The Moai statues have puzzled ethnographers, archaeologists, and visitors since the first European explorers arrived in 1722.*

the volcanic crater of Rano Raraku provided the material for the monoliths, or statues of large heads known as Moai, which are located along the coast and for which the island is famous.

### DEFORESTATION

The current vegetation is grass savanna and is devoid of natural forest/woodland, though there is convincing evidence that several species of trees and woody shrubs were once present, including at least one tree palm. Deforestation had occurred by the time Europeans arrived and its completeness is considered to represent an ecological disaster; certainly soil EROSION is a problem in places.

The island was first seen by the Dutch explorer Jakob Roggeveen, on Easter Sunday, April 6, 1722, an occasion that gave the island its name. There have never been any native mammals but there are indigenous insects, one species of lizard and several land birds, though at least six of the latter have become extinct from human impact. Some afforestation in the in-

terior of the island has been undertaken featuring eucalyptus species, and rodents such as rats and mice have become naturalized.

The origin of the Easter Islanders has been controversial. The anthropologist Thor Heyerdahl, proposed that they originated in PERU and built a balsa raft. He imitated their journey with native boats and sailed from Peru to the island to prove that the trip was possible. However, it is now accepted that they originated in Polynesia, possibly from the Marquesas Islands, and arrived on Easter Island about 600 years ago. The Moais, huge native statues, of which there are more than 1,000, were erected between 1000 and 1650 C.E. They are a major tourist attraction and there are rock paintings (petroglyphs) which also depict human life. The Rapa Nui National Park, covering most of the island, was established in 1935 to protect the archaeological remains. The islanders used Rongorongo script, the sole written language of Oceania.

Today, the population is about 3,000, having recovered from a major decline following initial contact with Europeans which brought disease and slavery. Tourism is a major source of work and income. There is a rich artistic tradition involving carvings, tattooing, and music.

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## ecological niches

IN CONTEMPORARY ecology, the term *ecological niches* is referred to as the position occupied by representatives of any life form (usually alive) in biocenosis, and, at the same time, the smallest unit of a habitat that is occupied by an organism. The notion reflects an organism's or species's place in the community, taking into account not only its tolerance to natural (physical) agents, but its interaction with other organisms as well. The ecological niche concept originated as an attempt to describe the general role of species in the community



and to differentiate on a theoretical level population, community, and ecological systems. The term had been introduced in 1917 by J. Grinnell, who interpreted it in a spatial sense as the ultimate distributional unit of a species. Later C. Elton (1927) concentrated mainly on niche functional aspects when describing an organism's place in its biotic environment in connection with its nutrition and animals.

The middle of 20th century marked a multidimensional approach to the niche concept in the works of L. Ramensky (1924), E. Odum (1968), and others. The multidimensional approach to niche comprehension allows scientists to conceive how species are connected with each other and, in such a way, enhances the understanding of a community's internal organization.

Further development of the niche concept is connected with the name of G. Hutchinson. In 1957, he interpreted niche as hyperspace, in frameworks of which conditions of the ambient allow unrestrictedly durable existence of specimen or species. According to Hutchinson, niche is defined by a general set of environment variables, to which species must be adapted (physically, chemically, biotically) and in which a species population lives and replaces itself indefinitely.

Such niches could be described mathematically with the help of quantitative characteristics of every environment's variable spatial coordinates. Hutchinson distinguished fundamental (now often called potential) niche (the whole set of optimal conditions that could be occupied by a species in its enemies' absence) and realized niche (a real set of conditions in which a species usually exists).

Today, a niche is often regarded as a way by which a species population fits into a certain community and in such a context concentrates on a species's connections in one community. So the niche concept also is concerned with the functional role of an organism in community (for example, its trophic status) and its position in relation to external factors of its habitat (such as temperature, humidity, etc.). It is especially useful for understanding the current distribution of sources among all niche inhabitants.

The latest developments in the framework of ecological niches are connected with a discussion about their attribution as a basic property of community or species. Some researchers believe that any niche is generated by its inhabitants, and its features are defined by the role that its creator is playing in its environment. Others regard niche as a community attribute and deny its significance in any other context. They reveal the phenomenon of ecological equivalence (or the principle

of convergent evolution): A niche is created by biotic and abiotic ecosystem components and exists a priori. It becomes filled in the course of a species's adaptations taking place during evolutionary changes; such species' adaptations should be similar even if these species are not interrelated.

### NICHE CHARACTERISTICS

Theoretical and empirical development of the ecological niche concept has put forward a series of niche characteristics, a major part of which is defined by function of utilization (or species activity distribution) along the resources' gradient. Most important among niche characteristics are the principle of competitive exclusion, niche width, niche axes, niche dynamics, niche interlocation, and so on.

The principle of competitive exclusion (or Gause principle) was proposed in the 1920s as the result of experimental investigations by G. Gause and J. Grinnell. Accordingly, two ecologically identical species could not survive simultaneously at the same place, or a niche is occupied by only one species. It was mathematically confirmed by the equation of Lotka-Volterra and has become one of the basic principles of ecology. In connection with the niche concept, attention should be paid to its corollary: If two species co-exist, they should differ ecologically, so every species has its own niche.

Niche width (or its size) notion is inherent to a multidimensional approach to niche interpretation. In its framework, it is defined as a general amount of all diversity of different features used by the population. Most often, it is identified through species activity distribution (resources utilization spectrum). Niche axes is a relatively new notion with a minimally independent set of limits in relation to species factors. It describes a series of important variables, such as form of population response to the axis challenge, relative width of species distribution along certain axes, grade of species overlapping, species's relative position along the axis, and other factors.

The niche dynamics concept envisions investigation of niche changes in at least three contexts. In an evolutionary framework, short-term, life cycle, and generational changes could be distinguished. The width of a realized niche also changes in response to competition and in relation with resource level. Community space changes in accordance with daily or seasonal rhythms. The niche interlocation concept describes niche differences, first of all, with time and place of activity and with ways of other species' communication. In such a

context, scientists have distinguished occasional (non-overlapping), discrete, and overlapping niches.

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## ecology

ECOLOGY IS THE study of the interaction between an organism and its physical environment. Human ecology specifically focuses on humans as a group of organisms and their mutual relationships within the habitat. The term *ecology* has its origin in two ancient Greek words: *oikos* (house or habitat) and *logia* (words or teaching). Thus, the concept of ecology has its origin the Greek *oikologia*, and could be rendered "teaching about the habitat." This article explores three dimensions of ecology in order: human ecology, political ecology, and biological ecology. The central theme that unites these three subsets is how humans interact with the Earth.

### HUMAN ECOLOGY

Often, the term *human ecology* is used interchangeably with *cultural ecology*. The human geographers find dialectical relationships between people and nature and consider cultures as a meeting ground of the two major elements of ecology: humans and environments. Each culture grows in a specific natural environment along with each human group and its living on the Earth.

Thus, it is crucial for human geographers and cultural geographers to study interactions between humans and environment to understand spatial variations of culture, its development, and distributions. Human ecology consists of these two approaches: 1) how an environment impacts and shapes a culture; and 2) the human influence on the habitat and making of cultural landscape through culture building. Employing these approaches, human ecology encompasses several branches and concepts, and this article discusses a few of them to facilitate understanding of the dialectical human-environment relationships.

Cultural ecology studies the mutual influences between human groups and the environment. Cultural ecology often qualifies culture as an effective mediator or medium for humans to facilitate their adaptation to physical environments. This process is called an adaptive system, and cultural ecologists render this system cultural adaptation. In this venue, cultural ecologists recognize the importance of studying plant and animal adaptations to understand human-environment relationships. Cultures are the basis of successful human adaptation to environment and its change through time.

Historically, food, clothing, shelter, and knowledge served to reduce human difficulties to subsist in the midst of powerful nature. These cultural traits are examples of an adaptive strategy, and the strategy includes almost all aspects of our culture that enables us to prosper on the Earth. Although cultures function as a meeting ground between human and environment, we should note that the same or similar physical environment produces no identical cultures. This fact indicates that each group of people employs the unique strategy to survive in its natural setting. The interaction between the unique cultural traits and surrounding environmental conditions always result in a making of individual adaptive processes. Thus, we can observe an omnipresent two-way relationship between human and environment.

The approach and themes within cultural ecology often function as the crossroads of cultural and physical geographers, and it is closely identified with four schools of thought: environmental determinism, possibilism, environmental perception, and humans as modifiers of the Earth.

All of the four pillars are particularly revealed in the studies in ethnic geography, folk geography, and the examination of ecology in popular cultures is another vital perspective in geography as an academic discipline today.

Generally, folk groups are more involved with their physical environments, thus tend to establish an intimate relationship with nature. Therefore, cultural ecology as a geographical discipline maintains a relatively close association with folk geography. Folk adaptive strategies are based on sustainability and are usually the opposite from those of popular culture. Sustainability is judged by how people use natural products and consume energy in a way that does not destroy the environment.

Among folk groups in particular, human interaction with habitat is intense as the people gain their

livelihood directly through the Earth: farming, mining, extracting other resources, herding, hunting, gathering, and fishing to name but a few. The folk ecology and adaptive strategies are usually inseparable, and this interrelationship is revealed in the making of folk languages. For example, folk languages tend to have the vocabularies based on their historical exploitation of the habitat as well as their religious act to protect themselves from environmental hazards.

The folk languages are often employed to tell stories; folktales were passed on in honor of their heroic figures, proverbs were charged with wisdom about the weather and the farming, and their traditional architecture show us how the folk groups successfully balance available resources and climate. How the folk groups subsisted is called the folkways, and these processes historically facilitated successful human adjustment to the physical environment.

Folk ecology can be similar to religious ecology by seeking the relationship between religion and nature; religious ecology studies how folk religions help guide people's local modification of the environment and shape their perception of nature. The dialectical relationship between humans and nature is again witnessed in this context—the habitat influences the formation of religion, and human desire to control the land increases as the religious hierarchy is facilitated in the community.

It is obvious that folk cultures maintain close contact with the Earth and are more sensitive about the qualities of habitat than popular cultures; this is because folk survival and prosperity tend to be more at the stake of physical surroundings. However, folk people, too, shape the landscape through their culture building, and it is not necessarily true that folk groups live in perfect harmony with their environment. It is always very difficult to maintain good balance between the two organisms: human and environment.

### ETHNIC ECOLOGY

Ethnic ecology studies how certain ethnic groups interact with their habitat through the process of making cultural landscapes. Ethnicity has a close link to cultural ecology as much as folk cultures do, and a strong correlation exists between people and physical environment in ethnic culture regions, in ethnic migration, and in survival of ethnic groups. Ethnic groups are occasionally created in a remote place from their source region. This is often caused by migration and/or relocation diffusion. Since those groups settled in distance, cultural preadaptation must be considered as an eco-

logical element. Preadaptation is a process based on a collection of adaptive traits, such as behaviors, ideas, and practices, possessed by a group prior to migration. This ability gives them the chance to survive in the new environment after migration or relocation diffusion. Preadaptation mostly occurs in groups migrating to an environmentally similar place to their original home, and the adaptive strategy from their source region should work effectively in the new destination.

Environmental perception of the new land is another key to understanding ethnic ecology. There is a general tendency for immigrants to unconsciously associate their new home with their abandoned homeland, thus finding the new home more similar to their original home than reality. In other words, they emphasize the similarities and minimize the differences between old and new homes, and this perception often causes some extent of distortion.

This perceptual process occasionally caused problems for ethnic farming groups, particularly early Western European immigrants to Americas. Sometimes crops that thrived well in the old homeland were not adaptive to the particular American environmental setting. This collapse in agriculture and farming resulted in economic breakdown, and it is often the case that the ethnic settlement was deserted. This result can be referred as an example of cultural maladaptation.

### ECOLOGY OF POPULAR CULTURE

In contrast to folk culture, ecology of popular culture is less evident because its link to the physical environment is weaker than that of folk culture. The major difference lies in its involvement with industrialization and technology. Thus, popular culture is often said to propose a mechanistic view of nature. The advent of modernity demolished direct human confrontation and involvement with many environmental forces, and people in popular cultures can cause ecological disasters as much as becoming their victims. In popular culture, knowledge of the physical environment is mainly gained indirectly through books, mass media, and safe and harmless artificial environment, thus there are little direct involvement with the Earth. This indirect relationship with habitat is likely to distort human environmental perceptions. Furthermore, the existence of popular culture leaves a dominant impact on ecosystems.

One model of distinctive interaction between popular culture and ecology is observed in how and where the members of popular culture wish to spend their leisure time. People in popular culture now spend

much free time in areas outside the cities, or at least this is what they wish. The last quarter of the 20th century witnessed the rapid growth of the demand for recreation zones, often consisting of artificial wilderness. Such an influx of people in former “wilderness” results in damage to the physical environment, which includes our habitat itself. It is ironic that the population cluster in cities and suburbs causes greater impact on the rest of the world; people who grow up in popular culture tend to carry their cultural values into nature.

The boom of recreational tourism is now an international phenomenon, and some countries have made natural areas more accessible to people, which results in harming the habitat. The UNITED STATES is one of the countries that separates national parks from wilderness areas. Yet the human impact on the environment remains a severe problem to this day. In this context, the cultural ecology of the city seeks how we should understand the inseparable relationships between the urban settings and their interplay with the physical environment through human involvement. The theme of cultural ecology helps us to organize information about this city-nature interaction within the framework of human-environment relationship.

### ECOLOGY IN POPULATION GEOGRAPHY

The theme of human ecology is applicable to the study of population geography as well. In a given ecosystem, a successful adaptive strategy allows a people's survival and the reproduction of population at the most basic level. However, population is always at the sake of the availability of local resources regardless of adaptive strategy, and climatic factors influence the people's choice of settlement locations.

Another prominent factor that affects population distribution is disease. Some diseases may attack domestic animals and deprive the people of food. Thus, such diseases may affect human population density in a given location. Perception of the physical environment also plays a major role when a group of people chooses where to settle and subsist—people are almost always in search of similar environments to their original home.

Various cultural groups often see the same physical environment in different and unique ways, and these individualized responses to a single environment also influence human distribution patterns. Adaptive strategies include how people modify their habitats through the development of their cultures. Particularly, significant alterations of physical environment often occur in

densely populated areas. Adaptive strategies are not always sustainable, and at present densities, these population densities are a particular reason why we face a worldwide ecological crisis in terms of supplying food and resources appropriately. Thus, the population explosion and the ecological crisis maintain a two-way relationship.

### POLITICAL ECOLOGY

This approach focuses on political phenomena on the Earth that revolves around the interrelationship between humans and the environment. Thus, political activities in a natural habitat bear a prominent focus, and therefore have a strong link with political geography. Political ecology studies how political and cultural processes shape society (human)-nature (environment) relationships. In many cases, people have a strong attachment to their habitat through the building of cultures. Political ecology can be considered as a marriage of geography and anthropology and is characterized as an interdisciplinary approach rather than a unified methodology associated with one specific discipline.

Environmental changes affected by political phenomena in indigenous or ethnic societies are typically common subjects in political ecology, but recently, the approach is increasingly applied toward industrialized societies to analyze diversities of human relationship and conceptualization of nature based on geopolitics and several other prominent theories.

Although geopolitics is often singularly associated with political geography, the idea of geopolitics is inseparable from the importance of terrain, soils, climate, natural resources, and other elements of the physical environment to our political society. The term geopolitics is often used to describe the influence of habitat on political entities. On the other hand, political authorities have powerful potentials to modify environment through the scheme-organized alteration of the landscape and even in the name of environmental protection. In these ways, political entities influence and are influenced by the physical surroundings, and here again, we come across with a two-way relationship between human and environment.

In the past, a country's survival was enhanced by “folk fortress,” which is a natural stronghold, such as surrounding mountain ranges, deserts, or seas; bordering marshes or dense forests; or outward-facing ESCARPMENTS. The folk fortress was a valuable natural protection of the city and people by shielding an entire country or at least its core area. Without natural defense, for example, Korea, a land bridge leading from



CHINA to JAPAN, has repeatedly been threatened by both neighbors. Korea's history tells us how difficult it is for a country without natural protection to maintain its independence and sovereignty. Distribution of terrain is closely related to the concept of the folk fortress. We agree that an ideal country has mountains and hills around its edges and plains in the interior to provide sufficient fortification and comfortable space for people's settlement to facilitate defense and to heighten identity of a cohesive country. FRANCE comes very close to the ideal in terms of its physical setting, but very few countries in the world enjoy similar environmental boundaries.

Other desirable borders are mountain ridges because they stand out on the landscape and cross thinly populated countrysides. In contrast, not all the topographical features are helpful in making of efficient borders and a cohesive country. Rivers usually do not serve as ideal borders because their nature of changing course and flowing through densely settled valleys, create potential problems for the countries on either bank. An undesirable arrangement of physical features are called environmental barriers and may disrupt a country's internal unity and isolate one part of a country from another. Environmental barriers grow separatist sentiments easily, such as internal mountain ranges in the case of PERU and SPAIN that provide guerrillas with potential bases. Both Peru and Spain have problems of internal unity, and it can be said that this is partly because of their unfavorable physical settings.

In comparison, seacoasts serve as the most efficient borders for making independent countries, as is represented by AUSTRALIA. The Australian seacoasts provide excellent natural boundaries against expansive or acquisitive neighbors. However, we should not forget that there are always exceptions to these generalizations, such as HAWAII, CUBA, and the PHILIPPINES. These interactions between human territoriality and topographical arrangements recur in several theories in political ecology as well as political geography.

Increasingly today across the world, the term *political ecology* has a far more restricted meaning than the scope discussed above. It refers to a form of political activism dealing with the issue of disputes of who controls natural resources and who makes the political decisions that impact the habitat and indigenous population. Power games and the politically charged environmental consequences of the struggle between haves and have-nots become the center of the new political ecology. Many political actions and decisions have a significant impact upon habitat, and warfare is

the most devastating of all political phenomena. War destroys resources systematically, and it is unfortunate that warfare has been a favored practice to resolve political conflicts throughout history.

From an ecological perspective, environmental catastrophe goes on as a result of modern high-tech warfare, which destroys the delicate balance between human and habitat. Even military exercises and various tests affect habitat severely, as is the case with a drastic oil spill. The first world's desire to control resources and territories often resulted in destruction of habitats and the displacement of indigenous peoples by the people of political economic power.

The lumber industry, commercial fishing, the development of open lands, and other enterprises are often seen as ecologically destructive, although these are not always directly involved with politics. It is time for us to rethink human involvement with habitat from an ecological point of view, and political ecology gives us fundamental insights to deal with this world. The United States is one of the countries that has a Green Party to pursue a political-ecological agenda, and the existence of this political party represents increasing concern of human impact.

## BIOLOGICAL ECOLOGY

This approach is based on the idea of ecosystem, which includes all the plants and living creatures in a given area in relation to their physical environment. The term *ecosystem* is a contraction of the phrase *ecological system*, which encompasses biological ecology. Biological ecology has a closer affiliation with the domain of PHYSICAL GEOGRAPHY, yet due to the nature of ecology as a mediator of all types of geographers, biological interpretation of the Earth also contributes to the studies of cultural geography.

In studying the Earth from biological ecology perspectives, the concept of biota serves as one of the foundations of this approach. The term *biota* refers to the total group of plant and animal life in a region. Biota is subdivided from flora to fauna. An ecosystem includes biota, that is, all the organisms, in a given area, but it is more than a community of plants and animals. The ecosystem as a concept is based on the holistic interactions among and between organisms. The ecosystem also involves the nonliving portion of the environment, which includes nutrients and energy, such as soil, rocks, water, sunlight, and atmosphere.

Thus, an ecosystem is an essential collection of plants and animals along within the surrounding environment and all the interactions among these organ-

isms. The energy flow among the various components of the ecosystem plays a crucial role in biological ecology, as it is responsible for determining how a biological community is built.

Another fundamental concept of biological ecology is called a BIOME. A biome provides us with the most appropriate scale for understanding world distribution patterns of species and identifies recognizable assemblage of plants and animals through interaction with its environment. A biome is usually classified on the basis of its dominant vegetation along with the bulk of the biomass, which is the total weight of all organisms in the biome, as well as the most obvious and conspicuous visible component of the landscape, such as tropical RAINFOREST, DESERT, and TUNDRA.

The survival of plants and animals depends on an intimate and sometimes precarious set of relationships with other elements of the environment. Throughout environmental relationships, there are two major factors at work: intraspecific competition, which happens among members of the same species, and interspecific competition, which exists among members of different species. Both plants and animals compete with one another in search of light, water, nutrients, and favorable habitat in a dynamic environment. There are recognizable and predictable patterns of biotic distributions based on environmental relationships.

Various climatic factors play a dominant role as the most prominent environmental constraints on biological ecology at almost any scale. The four major components of CLIMATE are light, moisture, temperature, and wind. Light and photosynthesis are responsible for activating plants to produce stored chemical energy, and light also has a significant influence on determining the shapes and sizes of plants.

Moisture is the second climatic factor to characterize biological ecology. The broad distribution patterns of the biota are mostly determined by the level of moisture. The process of biotic evolution has been characterized by the adaptation of plants and animals to scarcity, abundance, or excess in moisture availability. In biological ecology, moisture is often synonymous with water.

Although the availability of water is largely determined by these atmospheric conditions, it is not always dependent on climate alone, as the relationship with precipitation evaporation should also be observed. Air and soil temperature are also important to biotic distribution patterns. Moderate temperatures attract more species of both plants and animals that cannot survive in cold regions. Wind assists in creating ecosystems by

influencing biotic distributions with its physical strength of causing biota frying and sometimes even violently uprooting trees. On the positive side, wind sometimes aids the dispersal of biota by carrying pollen, seeds, lightweight organisms, and flying creatures to contribute to biological diversity in an area.

Characteristics of soil that vary from one region to another and its relationship with local organisms are known as edaphic factors. Edaphic factors bring major influence to biotic distributions. These factors have a direct and immediate impact on flora, but the impact is usually indirect on fauna thanks to most animals' mobility. As long as we live on the Earth, soil is a major component of the habitat of any vegetation, and its characteristics significantly determine rooting capabilities and nutrient supply through soil texture and structure, human existence, chemical composition, and relative abundance of soil organisms.

In global biological ecology, general topographic characteristics are the most important factors affecting distribution of flora and fauna, including human settlements. For example, the existing species of plants and animals in a desert region is very different from that in a woodland region. In a more localized context, the factors of steep slope and deep drainage are generally significant, as well as the orientation of sunlight, and other topographical characteristics of the soil on the slope influence the assemblage of plant and animal that survive in the area of consideration.

The distribution of plants and animals are mostly determined by environmental factors slowly and gradually through time. However, occasionally, some catastrophic events become the determinant factor of biota. These abrupt elements include floods, earthquakes, volcanic eruptions, landslides, insect infestations, and droughts. Among these elements, causing complete or partial devastation of the flora and the killing or driving away of all or most of the fauna, wildfire is one of the most devastating environmental catastrophes.

These results are likely to be temporary; vegetation sprouts and animals return in the long run as the biota recovers from damage. However, at the least, the composition of the biota is changed in the short run, and if the fires occur with frequency, they may destroy the mutual relationship between preexisting biota and biome completely, and thus the ecological change may be inevitable. On a brighter side, wildfire can be helpful to the seeding or sprouting of certain plants and the maintenance of certain plant interactions. In some cases, natural fires are evaluated to sustain grasslands by preventing the encroachment of the tree seedlings.

Moreover, there are a variety of plant species that need the heat of a fire to make their seedpods to open and spread their seeds. All phenomena and biota on the Earth are intricately interwoven, and ecology with many facets is a way for us to observe the Earth system as a whole.

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## economic geography

**KNOWLEDGE OF ECONOMIC** geography was first essentially descriptive, with a focus on the **REGION** and its economy, demography, and social characteristics. It represented the typical approach in research agenda in North America and Western Europe. The birth of economic geography dates from the age of European exploration, with an expansion in commercial geography from the 15th century to the 19th century. George Chisholm, author of the first book in economic geography, *Handbook of Commercial Geography* (1889), collected information on economic activity. In the late 19th century, economic geographers started to take into consideration the physical environment as influencing the economic activity.

The environmental determinist movement started with Ellen Churchill Semple's book (*The Influences of the Geographic Environment*, 1911), in which she explained how the environment is considered as a major factor in the location of human settlements and economic activity. The turn to the study of geographic regions gave birth to the areal differentiation movement in the mid-1930s, with Richard Hartshorne (*The Nature of Geography*, 1939).

The movement supported a geography that provided accurate, orderly, and rational descriptions and interpretations of regions. Economics has occupied a central position within human geography for more than a century, and started its modern development in

the 1950s. The post-1950s geography is characterized by the quantitative revolution.

The utilization of earlier location theoretic models by German spatial economists (Johann Heinrich Von Thünen, 1826; Alfred Weber, 1929; Walter CHRISTALLER, 1933; August Lösch, 1939) has contributed to the development of geography as a spatial science. The French economists, on their side, were working on the theory of **GROWTH POLES** and regional development problems.

Economic geography represents two areas very close to each other but with some nuances. It is referred first to as geographers working on spatial questions, with a synthetic approach from sociology, economics, political science, and history, reflecting the multidisciplinary character of the field of geography. Second, it is related to regional science with economists working on spatial mathematical models.

The work in the 1960s in quantitative geography was represented by William Alonso and Brian Berry. Alonso (*Location and Land Use: Toward a General Theory of Land Rent*, 1964), in the area of neoclassical economics associated with location theories was influential in urban land-use modeling. A William Alonso Memorial Prize was established in the United States by the council of the Regional Science International Association in 1999. Berry has worked, with his book *Geography of Market Centers and Retail Distribution* (1967), on market functions and spatial scale, focusing on settlement patterns and the hierarchy of places in national economies. Until the mid-1970s, with the main intellectual orientations of the neoclassical economics principles and of the German theorists, location has provided the new framework for the study of the spatial organization of the contemporary economy. Economic geography was, during the period, essentially an industrial geography dealing with the problems of industry and regional economic development.

The end of the postwar economic growth in major developed countries, the end of the golden age of capitalism, and the worldwide stagnation of regional and urban problems were all new questions for economic geographers. With the Marxist critique of capitalism, economics geographers switched their interests from neoclassical economics toward political economy, such as the Marxian political economy. David Harvey refocused his work toward a Marxist-based geographical political economy with his book *The Limits to Capital* (1982), which is still one of the best interpretations of Marx's work. From the mid-1970s to the mid-1980s, geographers dealt with the questions of regional and

urban problems, which included the logics and the dynamics of urban space, regional development and its crisis, the geographies of services, labor, and money, the restructuring of regional industries, and uneven development. Doreen Massey, with her book *Spatial Divisions of Labor: Social Structure and the Geography of the Production* (1984) on industrial restructuring, reacted to Harvey's abstract ideas by bringing a more concrete perspective of the place to the study of spatial relations.

From the 1980s on, economic geography has evolved in several field categories. Economic geography has taken a step toward critiques of the Marxist social and economic theory. This has led to a new turn in the development of capitalism, with the emergence of poststructuralist and postmodernist theories. Feminist geographers Katherine Gibson and Julie Graham, in their work *The End of Capitalism (as We Knew it): a Feminist Critique of Political Economy* (1996) on Marxist political economy, bring the concept of class as a central topic in economic analysis. They focus on the relationship between gender, social class, and economics and according to them, the discourse on Fordism and post-Fordism is too economic and male-centered.

## POSTMODERN PATHS

For Edward Soja (*Thirdspace: Journeys to Los Angeles and Other Real-and-Imagined Places*, 1996), postmodern ideas lead to a different path. The social complexity is originated from the importance of space and time. Influenced by Henri Lefebvre, Soja developed the model of the "Trialectic" of history, space, and society. He showed that spatiality, like history, is culturally produced, and that space is also a space of domination that is a representation of power and ideology.

Starting in the late 1970s, a turn to the resurgence of regional economies took place by economic geographers switching their interest from the areas dominated by the Fordist manufacturing activities to the high level of spatial agglomeration, including networking, innovation, and economic growth. Different schools of thought involving geographers, economists, and social scientists have emerged in works related to post-Fordism.

The first is represented by the Italian school with Giacomo Becattini (1987) and his colleagues at the University of Florence, who analyzed the Marshallian industrial district dealing with the location of new productions spaces. Three types of industrial districts were found: the local-, small-, and medium-enterprise net-

works in northeastern and central Italy, known as the Third Italy; the high-technology regional clusters in Silicon Valley, Orange County, and the highway 128 complex around Boston; and the London-Bristol axis.

The other school, the Californian school of geography, represented by Allen J. Scott, Michael Storper, and Richard Walker, and characterized by the study of industrial geography in southern California and the Bay Area, has a focus on flexibility in the division of labor in production. It also has analyzed agglomeration, including transactions costs associated with inter-firm linkages.

They recognized in the megalopolis or in the agglomeration some patchwork of districts. Although they had knowledge of regulation theory, their analysis was essentially based on neo-Marxism and neo-classical theories of labor division and the effects of external agglomeration. A third group can be discussed, the Groupe de Recherche Européen sur les Milieux Innovateurs (GREMI), created by Philippe Aydalot in 1986 and composed of geographers and economists studying new regionalism places such as Silicon Valley, Cité of Paris South, and Third Italy. The fourth is represented by Michael Piore and Charles Sabel, inventors of the concept of flexible specialization as a form of industrial organization in their book *The Second Industrial Divide* (1984).

According to the paradigm of Coase-Williamson-Scott that has emerged, industrial organization is always struggling between internal organizational costs in the firm and transactions costs between firms. Agglomeration of firms in a same location would minimize transactions costs, and thus be a factor in competitiveness. However, the flexibility of the production system has engaged new geographical dynamics, suggesting that networks of firms or smaller firms can respond more efficiently to changing consumer demands.

The Fordist spatial systems (vertical integration and spatial centralization) are less important and led the way to firms' agglomeration in search of minimal transactions costs. Michael Storper and Richard Walker, in *Capitalist Imperative: Territory, Technology, and Industrial Growth* (1989), have proposed a model of growth pole that has emerged in California. Allan Scott (1988) did a precise analysis of contemporary production systems, taking in consideration the social division of labor, transactions between the actors in the space of production, the different type of relations between the economic actors, and the role of political agencies. From the Italian district to world megalopolis,



the new paradigm of flexibility explains the return of production location and offices near urban areas and the revival of the quantitative growth of metropolitan cities. Geographers have analyzed the location of production, location of offices, space of logistics and distribution, organization, and locational choices and realized that the urban forms have changed compared to the postindustrial Fordist period.

Besides the ideas developed on districts and the evolutionists' approach to the diffusion of technological changes, another research idea has considered territory as an innovative milieu. The works on this topic have questioned the necessary external conditions that give rise to entrepreneurship and the adoption of innovation. Researchers do not consider that the firm is preexisting in the local milieu, but that the firm itself is created by them. Recent studies challenge the theories of industrial organization, industrial district analysis, and the evolutionist approach, which have been modified with the emergence and the diffusion of innovation. More emphasis has been put on the local milieu, the territory favorable to innovation.

### FRENCH SCHOOL

All the approaches described above, even if they do have common questions, do not converge on post-Fordism and the effects of milieu. For example, Danielle Leborgne and Alain Lipietz (1992), in their works on the institutions of social regulation and the forms of relations among firms, found the model of Marshallian district is not so important and is regulated by a combination of commercial relations and a reciprocal atmosphere. The French "regulation" school of Michel Aglietta and Alain Lipietz worked on the regulation theory to provide an understanding of the capitalist mode of production and its instability. It attempted to theorize the social and economic relations that support economic growth (accumulation). The functioning of the accumulation regime is deeply affected by the state and financial institutions that have an impact on the markets forces.

The French regulation theory has been very influential in explaining the transition in capitalism from a Fordist regime of accumulation and regulation to a new post-Fordist regime. Ash Amin (1994) applied the regulationist ideas to geography and proposed that the mass-production Fordist regime of accumulation has led to a post-Fordist regime. Piero Sraffa also contributed to economic structure and a linear production model has been influential in economic geography with Sraffa's book *Production of Commodities by Means of*

*Commodities: Prelude to a Critique of Economic Theory* (1960).

### LEONTIEF'S MODEL

Sraffa's model is a formalization of Marxian ideas of value/price and wage/profits relationships, and his model is identical to the input-output model of Wassily Leontief. The Leontief model influenced research on regional growth and the study of impact analysis developed by Walter Isard and Richard Stone. The neo-Marxian geographers integrated the Sraffa models in their model of capitalist crisis. Eric Sheppard and Trevor J. Barnes (*The Capitalist Space Economy: Geographical Analysis after Ricardo, Marx, and Sraffa*, 1996) studied the capital-labor conflict and showed that, when it is combined with the spatial interpretation of industrial cost and residential location, it explained the patterns of urban settlements, technological change, industrial organization, restructuring, and monopoly power. Michael Webber and David Rigby, in *The Golden Age Illusion: Rethinking Postwar Capitalism* (1996), mentioned that since the Sraffa-based spatial model already contains the possibility of an endogenous crisis because of the technological competition and the decline of the productivity, the regulationist ideas of decline of capitalism were not useful.

The rise of new technologies and new forms of economic organization lead toward profits and productivity growth. The new rise of competition in a global economy and the breakdown of the Bretton Woods system have been the driving force in this post-Fordist change of economy and geography. Network and governance are two key economic concepts that appeared in the 1990s.

Economic and geographical works have focused on the organization of the relation between unit production and its spatial development. In this area, a network is called the spatial dimension of regulation between productive units; moreover governance is the regulation mode of those relations which are in different forms: hierarchical, sub-contracted, or partnerships. Michael Storper and Bennett Harrison showed the great diversity of the governance mode that they take into consideration only if it organizes the inter-firms relations. It is a complex theory that comes from the domain of industrial organization, labor division, institutions and conventions, and the possible locations resulting from the modality of governance.

Spatial economists have elaborated on a new economic geography, which is a reflection of their increasing interest in the concept of space. This represents a



One aspect of economic geography studies the spatial distribution of financial resources in a given context. The graphic analysis of gross domestic product per capita above shows how productivity and income are distributed around the world.

recent tendency to add “new” to the term *economic geography*, particularly since the work of the MIT economist Paul Krugman (1991) entitled *Geography and Trade*. He took into consideration, for example, the role played by distance and place in international trade. Krugman tried to show how exchanges in a country are affected by the process of geographic industrial specialization and, in return, how the process can influence further exchanges.

In a slightly different perspective, for the business economist Michael Porter (1990), the geographic con-

centration of industry in a national economy plays an important role in the determination of sectors that have a competitive advantage within the international economy. The new economic geography adds to regional economics with specific modeling approaches.

Krugman has contributed to several topics relating to the problems of regional development, exchange, externality, industrial location, strategic industrial policy, and the consequences of the economic integration and monetary policy on regional growth. He has used several economic and geographic theories, taking into

consideration the locational economics of Alfred Marshall, cumulative causality, and traditional theories of location. The geographical emphasis by Krugman and others has been criticized because of their modeling of space that is too narrow; their interest is in the description of abstract space and not in a specific place.

The 1980s and the 1990s have been marked by works on the metropolis. The city has been studied from the angle of the production system, with the apparition of the post-Fordist city concept. Globalization has certainly transformed the structure of urban societies. John Friedmann has established a world urban hierarchy using the location of headquarters and decision centers of corporations and international organizations. It is an extension of the theory of urban hierarchy that affirms that the geographical deployment of multinational companies is a function of the transactions done by the companies. The problem of globalization is an important topic for economic geographers, particularly since the increase in multinational corporations operating at a global level but also because of a new movement in capital. In effect, capital becoming more mobile.

### GLOBAL INFORMATIONAL CAPITALISM

Manuel Castells, in his three volumes, provides an interesting and complete analysis of global informational capitalism (1996, 1997, and 1998). Castells emphasized the role of information and telecommunication, leading to the territorialization of the economy and society, and he developed a new spatial logic called the space of flows. The flows are structured in networks dominated by big companies and by managerial elites. Information is the key input of the world economy for the formation of capitalist agglomeration. Information, new technologies, and restructuring in the capital-labor relation induce the emergence of new urban forms. Thus, the informational city is on the rise.

Saskia Sassen (*The Global City: New York, London, Tokyo*, 1991) developed the concept of the global city. She showed that globalization can be seen only in some cities, such as NEW YORK, LONDON, and TOKYO, where banks, corporate headquarters, and high-level functions are strategically concentrated. Decisions made in these global cities can affect jobs and wages, but also the conditions of the economy in more remote location such as in MALAYSIA, CHILE, or other places. The three cities are global because of the structure of their activities (industries and international services), the qualifications of the labor force, and relative productivity.

Globalization as an economic and geographical phenomenon that has gained interest from geographers. The origin of this interest comes from the older geographic research on the international division of labor and the activities of multinational corporations. Moreover, the region as a source of competitive advantage in the globalization process of the economy, has received special study (Porter, 1990, 1998; Saxenian 1994; Scott, 1998). Another characteristic of globalization is the dual structure of society, in which there are elite with high incomes living side by side with poor workers. Global cities have accumulated wealth, decision centers, research laboratories, and financial centers. But such growth is accompanied by a decline in some economic sectors, degradation of vast urban areas, structural poverty, and chronic insecurity. At the international level, there is a consolidation of socioeconomic geography, which involves economics and the social components of space. Studies of post-Fordism, innovative milieus, industrial districts, governance, local production systems, and the economy of proximity are increasing.

Globalization, with its creation of borderless markets, mobility of finance, transnational firms, and an information economy has signaled the “end of geography” (Richard O’Brien, 1992) and the “death of distance” (Cairncross, 1997). According to some these theorists, globalization is rendering the location of economic activities less relevant.

For others, globalization is increasing the importance of location and that is promoting regional economic distinctiveness. Spatial clustering, a concept at the core of economic geography, has been developed to explain the advantages of being in the same place as others to generate economic processes.

Recently, economic geographers became interested in telecommunication technologies and the changes brought on by the internet. These studies are represented by Stephen Graham and Simon Marvin in *Telecommunication and the City* (1996), Rob Kitchin in *Cyberspace* (1998), Manuel Castells in *Internet Galaxy* (2001), and Graham and Marvin in *Splintering Urbanism* (2001).

The boom of the new economy based on the information technology and the internet came to end with the economic downturn in 2001. But geographers, such as Thomas Leinbach and Stanley Brunn (*Worlds of E-Commerce: Economic, Geographical and Social Dimensions*, 2001), have just begun to analyze the relationships of virtual spaces of telecommunication networks and conventional geographic spaces.





Globalization and global cities, such as New York, are central to the study of economic geography today.

The end of the 1990s brought a change in internet distribution methods, with e-commerce heralding a new digital economy. However, commercial transactions, even on a global basis, still depend on the management of the logistic side of geographic space and time. Into the 21st century, a new era of profound economic change emerged with strong implications for economic geography. Economic geography will continue to focus on aspects relating to change in the human economic system.

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## ecosystem

THE CONCEPT OF the ecosystem began with the establishment of the science of ecology which is credited to Ernst Haeckel, a German zoologist who coined the term *ecology* in 1869. He based this term on the Greek word *oikos*, meaning “a place in which to live.” It was another 60 years before the term *ecosystem* was introduced in 1935 by Sir Arthur Tansley, a British ecologist and supporter of environmental conservation.

In a classic publication in the journal *Ecology*, Tansley defined ecosystem: “The more fundamental conception is the whole system including not only the organism complex, but also the whole complex of physical factors forming what we call the environment. We cannot separate them (the organisms) from their special environment with which they form one physical system. It is the system so formed which provides the basic units of nature on the face of the Earth. These ecosystems, as we may call them, are of the most various kinds and sizes.”

Thus, an ecosystem comprises a group of coordinated components of the environment; such components may be biotic, that is, relating to life such as plants, animals, humans, or abiotic, that is, relating to non-living components of the environment such as water, soil, climate. All ecosystems are organized and structured; the biotic and abiotic elements and the links between them can be identified and in many cases quantified. All ecosystems function via the relationships between the components. Their natural state is one of dynamic equilibrium whereby a balance exists between the components that is maintained through negative feedback or self-regulation. Thus, the character and functions of the ecosystem prevail.

If imbalance occurs, because of an external stimulus such as climatic change or an internal agent such as human activity, positive feedback will occur. Alterations in the components and their functions occurs until a new equilibrium, that is, an ecosystem with dif-

ferent characteristics from the original, is reached. The reaction of ecosystem components to positive feedback is rarely immediate because of inherent resilience to change, which takes time to overcome. Consequently, most stimuli will generate a lagged response as thresholds of resistance are overcome. Moreover, ecosystems may be defined at any scale. At one end of the spectrum is the Earth itself, or more specifically the biosphere, which is the zone adjacent to the Earth's surface where all life exists, and at the other end of the spectrum is a small pond. Ecosystems are open systems insofar as they can be influenced by external factors and there may be imports and exports of mass and energy.

One ecosystem function involves the cycling of chemical elements and compounds. This movement of chemicals between the biota, soils, oceans, and atmosphere is biogeochemical cycling. Each chemical has several major pools or reservoirs between which fluxes or exchanges occur. If the atmosphere is involved, the biogeochemical cycle is described as gaseous, but if there is no atmospheric component, the cycle is considered to be sedimentary. Carbon, nitrogen, hydrogen, and oxygen (the latter two are combined as water) have gaseous biogeochemical cycles, as they all have significant reservoirs in the atmosphere.

Moreover, the volumes of these elements, especially carbon as carbon dioxide and methane, in the atmosphere influence climate. Thus the Earth's biotic and abiotic components are arbiters of climatic change which in turn affects the distribution of the biota and the functions between the biota and abiota. Examples of sedimentary biogeochemical cycles are those of phosphorus, calcium, sodium, and magnesium in which the major reservoirs are the biota and soils between, with fluxes operating through the medium of water.

Another major function within ecosystems is energy flow. It is quite essential for life and involves the harnessing of solar energy which, despite the sophistication of human society, can be achieved only by green plants. All animals, including humans, are dependent on this function. Called photosynthesis, this is a complex biochemical process undertaken by terrestrial and aquatic plants that contain chlorophyll. Carbon dioxide and water are combined in the presence of solar energy to produce carbohydrates, which are a source of energy for the plants and from which all other plant components are manufactured. The efficiency of photosynthesis depends on water, nutrient, and light availability. This manufacture of carbohydrates is known as primary productivity.

Plants are the first stage in energy transfers in ecosystems, while the second stage involves food chains and food webs. Animals feed on the primary producer plants and other animals feed on these primary consumers. Humans are omnivores and feed on both plants and animals mostly produced in agricultural systems which are essentially intensively managed ecosystems.

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## ECOWAS

THE ECONOMIC COMMUNITY of West African States (ECOWAS), also known in French as Communauté Économique des États de l'Afrique de l'Ouest (CEDEAO), was first formally set out at the Monrovia Group meeting in April 1968. By the Treaty of Lagos, 15 representatives from West African states formed ECOWAS in Lagos, NIGERIA, on May 28, 1975. These were: BENIN, BURKINA FASO, CAMEROON, CÔTE D'IVOIRE, GAMBIA, GHANA, GUINEA, GUINEA-BISSAU, LIBERIA, MALI, NIGER, Nigeria, SENEGAL, SIERRA LEONE, and TOGO. CAPE VERDE later joined the community making it a 16-member economic organization. Based on their colonial experience, three official languages are spoken in West Africa: English, French, and Portuguese.

The principal objective of the treaty is the creation of an economic and monetary union. To this end, a regional trade liberalization scheme was adopted for the creation of a free trade area at the end of 1999, and a common external tariff is being implemented in phases. The three-phase program for the free movement of ECOWAS citizens has been completed. ECOWAS has pursued the physical integration of its member states through the modernization of regional highway and telecommunication networks.

ECOWAS became effective in July 1975, when the necessary seven states ratified the treaty. The first meetings of the Council of Ministers and the Authority of Heads of State and Government took place in Lomé, Togo, in November 1976, at which time additional

protocols to the treaty were signed. In July 1993, the 16 West African heads of state signed a revised treaty, reflecting West Africa's regional cooperation experiences over the preceding 15 years, and taking into account the exigencies of continental integration as envisaged in the Treaty of the African Economic Community.

Member states committed themselves to coordinating and harmonizing varied national economic and financial policies in order to enhance the effectiveness of national structural adjustment and economic reform programs. The ultimate goal is to facilitate the regional approach to economic development and the establishment of the monetary union. The monetary program adopted by ECOWAS has the medium-term objectives of achieving regional convertibility of the nine national currencies and, in the longer term, the creation of a single monetary zone. Meanwhile, an ECOWAS traveler's check was launched in October 1998 to facilitate regional travel and commercial transactions.

### UNIFORM CURRENCY

As part of efforts to realize its uniform currency and monetary system, a West African Monetary Institute (WAMI) became operational in January 2001. The two-year transitional body is based in Accra, Ghana. There is also a Committee of Governors of West African Central Banks that has been coordinating the implementation of the ECOWAS monetary program through the West African Central Bank. A uniform currency was scheduled to come into effect in 2004.

In addition, ECOWAS is embarking on such programs as the interconnection of national electricity grids; a regional pipeline for the distribution of natural gas; community seed production and cattle breeding centers; agricultural research; a regional master plan for industrial development; coordination of desertification control; rural water supply plans; cooperation in health matters; and establishment of equivalence for degrees and diplomas.

In the treaty, particular emphasis is placed on promoting the involvement and participation of the private sector and the general public in the development and integration of the economies of the region. ECOWAS encouraged the establishment and functioning of a privately owned regional commercial bank (ECOBANK), as well as the Federation of West African Manufacturers Associations, Federation of West African Chambers of Commerce, West African Journalists Association, West African Youth Union, West African Women's Association, West African Road

Transporters Union, and others. ECOMOG was created to act as peacemaking apparatus for member countries.

The Authority of Heads of State and Government is the supreme organ; it has a rotating chairmanship and meets at least once a year. The Council of Ministers comprises two representatives from each member state and also has a rotating chairmanship. It meets at least twice a year; decisions are made by a consensus. The Executive Secretariat is headed by an executive secretary appointed for a four-year term.

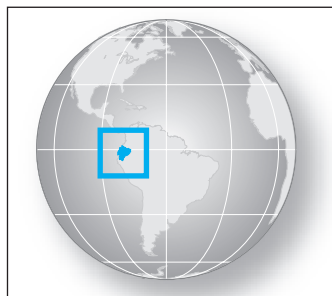
There are also five specialized commissions dealing with different aspects of cooperation. Provided in the treaty is a Court of Justice to ensure “the observance of law and justice, to interpret the provisions of the Treaty, and to settle disputes referred to it.” The seven justices for the court, which is based in Abuja, Nigeria, were sworn-in in January 2001 in Bamako, Mali. The treaty provides for a West African Parliament, inaugurated in Bamako, Mali, on November 16, 2000.

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## Ecuador

**Map Page** 1139 **Area** 109,483 square mi (283,560 square km) **Population** 13,212,742 (2004) **Capital** Quito **Highest Point** 20,561 ft (6,267 m) **Lowest Point** 0 m **GDP per capita** \$3,300 **Primary Natural Resources** petroleum, fish, timber, hydropower.



ECUADOR IS A SMALL country located on the west coast of South America. The equator crosses the country, thus giving Ecuador its name. The country is bordered by the PACIFIC OCEAN to the west, COLOMBIA to the north, and PERU to the east and south. Territorial

disputes with both Colombia and Peru have reduced Ecuador's territory.

The Pacific coastal zone, mainly an ALLUVIAL PLAIN, consists of 60,000 square mi (155,399 square km) of land between the ANDES MOUNTAINS and the Pacific Ocean. These lowlands form the widest coastal plain in South America, reaching widths of 125 mi (201 km). While there are some hills, the region is largely flat. The northern coastal region is largely RAINFOREST, while the south consists of tropical woodlands. The region contains a number of important river valleys. Some of the rivers are navigable for long distances, with the basins of the Guayas, Esmeraldas, and Santiago rivers creating an extensive inland waterway network.

The key area of the coastal zone is the Guayas Lowland, where much agricultural production takes place. This agricultural production is geared to the export economy. The main crops include cocoa, coffee, bananas, and rice. Others regions of the coastal lowlands are used for fishing and cattle raising. Ecuador has also exploited oil reserves in the coastal region. Thanks to the presence of such resources, the coast has long dominated the economy of Ecuador.

The main city of the lowlands is Guayaquil, located on the western bank of the Guayas River. Guayaquil is an important port and commercial center, serving as an outlet for the region's products. It is also the country's largest city.

Known as the Sierra, the Andean highlands of Ecuador make up about one-fourth of the country's territory. These highlands are made up of two cordilleras, or ranges. The Ecuadorian Andes are narrow but high, averaging an altitude of over 10,000 ft (3,048 m). The ranges consist of high, snow-topped, volcanic peaks. The highest peaks are Chimborazo, which reaches an altitude of just over 20,000 ft (6,096 m), and Cotopaxi, which is just under 20,000 ft. In addition to dozens of volcanoes, the region is also subject to strong earthquakes. For example, an earthquake in 1797 completely destroyed the city of Riobamba, forcing survivors to rebuild at a new location.

A 300-mi- (483-km-) long intermontane plateau is located between the eastern and western ranges. Transverse mountains divide the plateau into 10 basins at elevations between 7,000 ft (2,133 m) and 10,000 ft (3,048 m). The basins fall into one of four climatic zones. The area above 10,065 ft (3,246 m) is known as *páramo*, which is barren and windswept. The *páramo* is generally used for pastureland and to grow potatoes, a crop native to South America. At elevations of 8,052

ft (2,454) to 10,065 ft (3,246 m) is the altiplano, used for both pasture and growing grains. Temperate valleys can be found at altitudes from 6,039 ft (1,840 m) to 8,052 ft (2,454 m). Temperate crops are grown in these valleys. Finally, from 3,018 ft (920 m) to 6,039 ft (1,840 m) are tropical valleys, where in addition to potatoes and grains, Ecuadorians grow cotton, sugarcane, and fruits.

This plateau forms the densely populated heart of Ecuador and has historically dominated the country. Pre-Hispanic cultures centered here and the Spanish preferred the Andean plateau over the coastal zone. Quito, the capital city, is located in the plateau at 9,350 ft (2,850 m). The region contains a large percentage of Native Americans and mestizos (mixed race).

The hot and humid eastern lowlands of Ecuador are known as the Oriente. This region comprises about half of the country's territory. The Oriente has often been at the center of territorial disputes, and Ecuador has lost large sections of this region to its neighbors. It covers the area stretching from the eastern foothills of the Andes to the AMAZON RIVER basin. Much of the Oriente is a FLOODPLAIN covered with tropical woodlands and rain forests. There are navigable rivers in the region. However, they generally flow away from the settled areas, making them of limited use.

Historically, the Oriente has been isolated, underdeveloped, and sparsely populated by humans. Before the 1960s, both settlement and investment in the region were very limited. Ecuadorian authorities paid attention to the area only when border disputes arose. The fact that most of the population consisted of Native Americans further contributed to government neglect.

Heavy rainfall has made human settlement unattractive, as dry land shrinks during the rainy season, wild game is scarce, and agriculture is difficult. In the northern Oriente, annual rainfall can reach 167 in (424 cm). After the 1960s, the government became more interested in the Oriente due to the discovery of significant oil deposits. High world oil prices in the 1970s led to increased investment in the region.

Ecuador is also home to the famous Galápagos Islands, where Charles Darwin conducted experiments there in 1836 leading to his evolutionary theories. Known as the Archipelago de Colon, the Galapagos Islands consist of five larger islands and nine smaller ones.

The islands are located in the Pacific Ocean about 600 mi (965 km) west of the mainland. Their total area is just under 3,000 square mi (7,770 square km) and

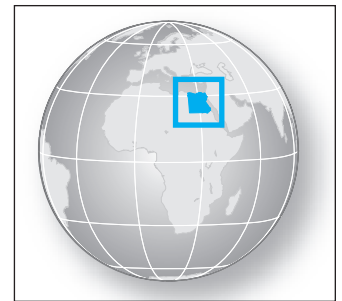
there are few inhabitants, most notably because potable water is scarce.

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## Egypt

**Map Page** 1114 **Area** 622,272 square mi (1,001,450 square km) **Population** 70,712,345 (2002) **Capital** Cairo **Highest Point** 8,625 ft (2,629 m) **Lowest Point** -436 ft (-133 m) **GDP per capita** \$3,700 **Primary Natural Resources** cotton, rice, corn.



EGYPT HAS BEEN a unified state for more than 5,000 years and is one of humanity's oldest civilizations of great political systems and unique art and architecture. Centered on the NILE RIVER, which drains the uplands of East Africa, early Egyptians worshiped the river that brought seasonal flooding and sediments to its river valley, annually rejuvenating its fields and orchards.

As the most populated country in the Arab world, most of its 70 million residents live in Cairo and Alexandria, the river delta and valley, and along the Suez Canal. The remaining desert villages are associated with isolated oases and caravansary routes. The government has repeatedly tried to entice residents to move from the dense cities to rural settings; however, Egypt's cities have continued to grow.

The population density of Cairo (al-Qahirah) is the highest in the region and is exceeded globally only by mega-cities like HONG KONG, NEW YORK CITY, and MUMBAI. With more than 350,000 people per square mile (136,000 per square km) and a total population of more than 15 million residents, Cairo is bustling city of luxurious skyscrapers and tin hovels, separated by zigzagging passageways and broad boulevards, all cramped with buses, tourists, cars, vendors, taxis, busi-



nessmen, and occasional fruit-filled carts. It is a city of dichotomies, with discos and mosques, fruit stands and department stores side by side, all divided by the Nile, the world's longest river during the rainy season.

Once beyond the lush fringe of the Nile, the arid lands of Egypt are formidable. The harsh land is occupied by native Bedouins and undaunted explorers and researchers. Daytime summer temperatures in the western desert can reach 130 degrees F (55 degrees C) with relative humidity as low as 5 percent. Perpetually battered by the SAHARA DESERT's desiccating winds, climatologists consider it one of the driest lands on Earth.

Although its desert interior is hyper-arid, Egypt's delta is lush, humid, and productive. Ninety percent of Egypt's agriculture is confined to 3 percent of the land: the delta and the narrow belt that lines the MEDITERRANEAN SEA and the Nile River from Cairo to Aswan. Because of its increasing population and small farmlands, Egypt must import increasingly more vegetables and fruits, although agriculture remains an important sector of the economy, contributing 14 percent to the GDP and employing nearly 30 percent of the total employed population. Despite this land of extremes—very rich to destitute, very humid to hyper-dry, open deserts to cramped suburbs—Egypt remains famous for its cheerful and generous people, whose hospitality is as legendary as its pyramids.

Since Egypt's earliest known ruler Menes created the first pharaonic dynasty in 3100 B.C.E., Egypt has continued to exert power throughout the region. As the kingdom expanded, monumental pyramids and temples were built, and repeated raids by Persians, Greeks, and Romans changed Egypt forever. Influence shifted from Memphis to Alexandria in 322 B.C.E. under Alexander the Great and became a mighty force on the Mediterranean Sea. The Ptolemaic rulers (like the renowned pair of Cleopatra and Marc Antony) guided Egypt until it was conquered by Arab marauders in 643 C.E. and converted into an Islamic state.

Following the Arab invasion and a transfer of power to Cairo as its new center, Egypt was controlled by a series of Arab, Mamluke, and Ottoman caliphs, sultans, beys, and pashas. Ottoman Turks ruled from 1517 to 1882, with a brief interruption by French rule under Napoleon Bonaparte at the end of the 18th Century. Mohamed Ali, an Albanian officer in the Ottoman Army, was appointed pasha in 1805 and founded a dynasty that ruled the region, built the Suez Canal, and modernized Cairo. In 1952, the great-great grandson of Mohamed Ali, Farouk I, was defeated. However, it was after a skirmish with Ottoman troops

in 1882 that the British successfully occupied Egypt until the kingdom declared its independence from England in 1922. The Egyptian government nonetheless, remained codependent on English ways and endured their use of Egypt for bases of operations during World War II.

In 1948, Farouk was blamed for the loss in the war with the newly created state of ISRAEL, leading to his defeat during a military coup led by Colonel Gamal Abdel Nasser in 1952. Nasser's charisma complemented his strong leadership skills and a new brand of regional socialism. After his death in 1970, Anwar al-Sadat served as president until his assassination in 1981. Strong ties were forged between Egypt and other nations during this period, including the Soviet Union, which supported the two-year construction of the Aswan High Dam (Sa'ad al-A'ali) and the impoundment of Lake Nasser in 1970.

After Sadat's assassination by Islamic radicals, an Egyptian Air Force commander, Hosni Mubarak, was elected president. Into the 2000s, he has continued to support a number of Middle East peace accords, and his attempts to increase private sector involvement and investment in Egypt have proved successful so far. Mubarak has since been reelected three times, continuing to deal with national concerns of poverty, crime, overpopulation, and poor water resources.

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## El Niño and La Niña

EL NIÑO AND La Niña are parts of global weather systems that recur every two to seven years. An El Niño, which usually lasts 12 to 18 months, is characterized by warm winters and wet springs in North America, a lessening of monsoonal rains in Asia, and droughts affecting Africa and the south PACIFIC OCEAN. A La Niña system follows for up to three years, producing opposite effects.

Southern Oscillation indicates the variations in sea level pressure noted in the Pacific between the southern and northern hemispheres. Both El Niño's and La Niña's are considered part of the El Niño Southern Oscillation (ENSO), a term used to describe the full range of wind and ocean patterns reflected in the Southern Oscillation itself. An El Niño occurs when the northeast tradewinds of the south Pacific slacken, and in the same area, ocean water warms and moves east. This action can reverse the trade winds by causing an increase in warm air, which rises and changes air pressure patterns. Abnormally dry weather then settles over islands in the tropical Pacific like INDONESIA, BORNEO, and the PHILIPPINES, while humid, warm air affects the west coast of South America.

Over several months, an El Niño impacts world weather patterns. In winter, the U.S. Pacific northwest and western CANADA get less rain, while southern CALIFORNIA and the Gulf Coast experience more rain and storms. Also in the UNITED STATES, warmer temperatures affect the Great Plains and upper midwest. BRAZIL, southern Africa, and AUSTRALIA experience dryness and drought. Rainfall lessens and drought often hits INDIA and southern Asia. Monsoonal moisture, a critical element on which all farmers depend, may not arrive, and the result is famine, often followed by diseases and death. Fewer hurricanes develop in the ATLANTIC OCEAN, and less rain falls in MEXICO and the southwestern UNITED STATES. In the Pacific Ocean, more typhoons occur.

Clearly, aberrations in the weather can cause great hardship and loss of life. The loss of monsoon rains in India for several years in the 1890s caused a famine that claimed over 4 million lives. An El Niño brings other troubles as well: Abnormal ocean temperatures keep fish from shore, ruining coastal economies. Normally dry high altitudes get snow, and months later when the snow melts, mudslides and flooding can follow. Huge brush fires, sparked in unusually dry conditions, can devastate large areas; in 1997 and 1998, fires in Indonesia caused at least \$9 billion in damage and lost timber, as well as dramatically polluting the air throughout Southeast Asia to such an extreme extent that the sun could not be seen for days in some cities. Even when the fires were extinguished, underground peat continued to burn, contributing to the pollution.

An El Niño is typically, but not always, followed by a year or more of La Niña conditions. During La Niña, also called an El Viejo, the temperatures in the equatorial Pacific region are colder than normal. This results in wet winter weather in the South Pacific and

southern Asia, and drier conditions along the South American coast. In the United States, winter temperatures are warmer in the southeast and cooler in the northwest.

The history of the ENSO goes back thousands of years, but it was not identified until recently. In 1891, the president of the Lima Geographical Society first officially reported that fishermen in PERU sometimes noted a warm countercurrent in the Pacific Ocean right after Christmas that indicated more rain, exotic fish, and lots of vegetation would come the following year. The locals called it El Niño, a term referring to the Christ child. Although droughts, floods, and seasons of unusual weather had been noted and even studied for years, it was not until the 1920s that scientist Gilbert Walker identified the Southern Oscillation. In the 1960s, Norwegian meteorologist Jacob Bjerknes connected Walker's discovery with the extensive ocean warming of an El Niño system. He described the anomalous circulation patterns that followed, and named them the Walker Circulation.

Scientists, historians, archaeologists, and researchers all over the world are now putting events and data together, realizing that weather systems such as the ENSO last for years and have impacted civilizations on a global scale for millennia. Events once considered random and unrelated are now being explained in terms of climatic events. El Niño droughts were likely responsible for the downfall of the Mayan civilization in Central America, the Moche Empire of Peru, and the Anasazi complex of the American southwest. Glacial ice cores, coral reefs, and tree rings provide evidence of ancient weather patterns and anomalies.

The El Niño of 1997–98 was one of the worst in recent memory. The fires of Indonesia have been mentioned; large economic losses impacted many areas, such as Australia and Southeast Asia, where drought occurred. Ironically, this El Niño came with much advance warning, and areas like heavily populated California were able to invest millions of dollars in preparation, thus avoiding more losses.

Groups such as the National Oceanic and Atmospheric Administration (NOAA) predict and track El Niños using satellites, research ships, buoy arrays, computer modeling, and other tools to analyze ocean temperatures, wind speeds, fish populations, precipitation, and other early indicators of developing weather systems.

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## El Salvador

**Map Page** 1136 **Area** 8,108 square mi (21,000 square km) **Population** 6,470,379 **Capital** San Salvador **Highest Point** 8,956 ft (2,730 m) **Lowest Point** 0 m **GDP per capita** \$4,600 (2002) **Primary Natural Resources** coffee, sugar, corn, rice, beans.



THE REPUBLIC of El Salvador is located on the PACIFIC OCEAN in Central America, between GUATEMALA and HONDURAS. It is the smallest Spanish-speaking nation in the Western Hemisphere. The country is a democratic republic with a strong executive branch, a unicameral legislative assembly, and a supreme court. For administrative purposes, the country is divided into fourteen departments, which all together make up a territory slightly smaller than the state of MASSACHUSETTS.

Having gained independence from SPAIN in 1821, El Salvador developed slowly but remained reliant upon its cash crop economy and monoculture based upon coffee sales. The country was also war ravaged throughout the 1980s and into the 1990s by a 12-year civil war that completely destabilized the country and claimed an estimated 75,000 lives. Finally brought to a close in 1992, when the conservative government signed a political reform agreement with leftist rebels, the end of the civil war did not automatically result in progress.

More recently, El Salvador has suffered two major natural disasters: Hurricane Mitch in 1998 and a strong earthquake in 2001, both of which brought the country to a standstill. More positively, inflation has finally dropped to single-digit levels recently and exports

have grown significantly, even though world coffee prices remain relatively low. El Salvador has a massive trade deficit, but the majority of it is offset by the tremendous amount of remittances sent back to El Salvador by its citizens living in the UNITED STATES, which amounts to over \$2 billion annually.

### EARTHQUAKES

Geologically, El Salvador rests atop one of the most active tectonic plates, resulting in a high frequency of earthquakes and volcanoes. The country has suffered a long history of earthquakes, consequential in the recorded destruction of the capital city in 1756, 1854, 1919, 1982, 1986, and more recently, in 2001. Two of El Salvador's 20 known volcanoes are active, known as Miguel and Izalco, but violent eruptions are rare. In fact, their eruptions are often enjoyed from safe distances by viewers who awe at the glowing lava that slowly turns into a brilliant luminous color during the night after a minor eruption. The glow from the Izalco volcano has earned the mountain its nickname as the "Lighthouse of the Pacific."

Two mountain ranges cross the country from east to west and a central plateau rests between them, while a very thin area of coastal plains is found along the Pacific Ocean. The northern range, known as the Sierra Madre, forms the border with Honduras. Once heavily forested, the region has been irreversibly damaged by logging and agriculture. The southern range is actually a chain of clustered volcanoes. The central plateau in between is home to a majority of the country's population and the largest cities.

The country's only navigable river, even though it has over 300, is the Rio Lempa, which flows out of Guatemala, through the central plateau, and cuts through the southern mountains, eventually emptying into the Pacific Ocean.

El Salvador's climate is tropical with clearly distinguishable wet and dry seasons. Temperatures vary by altitude only and not by season. The Pacific lowlands are often unbearably hot, while the highlands and central plateau are more moderate.

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## Elbrus, Mount

MOUNT ELBRUS IS the highest point in Europe, at 18,513 ft (5,642 m). It is the central peak of the CAUCASUS MOUNTAINS range, located 6.8 mi (11 km) north of the main ridge that forms the boundary between GEORGIA and RUSSIA, thus placing the mountain within Europe, since the traditional dividing line between Asia and Europe is along the main ridge of the Caucasus. The closest large town is Tynyauz, in the autonomous region of Kabardino-Balkaria, while the largest city with air and rail links is the Russian city of Pyatigorsk, 62 mi (100 km) to the north.

Elbrus is an extinct minor volcano that retains its conical shape characteristic of volcanic peaks. There are two summits, which are actually quite close in elevation. The lower summit (to the east) is only 72 ft (21 m) lower. In between the two, the area known as the Saddle has an elevation of 17,769 ft (5,416 m). Other notable features are the Pastukhov Rocks, at about 15,400 ft (4,700 m). The snow line in August lies at about 11,483 ft (3,400 m), above which the mountain supports a permanent icecap and 22 glaciers that covers about 56 square mi (144 square km). The runoff from these glaciers feeds major rivers, including the Baksan, Kuban, and Malka, flowing either west to the Sea of Azov, or east to the CASPIAN SEA.

Mount Elbrus was known to the ancient Greeks (called Mount Strobilius) and was the setting of the myth of Prometheus, chained to a rock atop this peak as punishment for bringing fire to humanity. Mountaineering became popular in the region from the late 19th century, accelerated by the first successful ascent to the top in 1874, followed by state sponsorship by the Soviets in the 1930s.

The mountain became one of the symbols of communist society's dominance and control of the wilds of the natural world. Since then the sport has only increased in popularity, resulting in frequent crowds of rock climbers. Visitors use cable car systems built in the 1960s, from the nearest mountain villages (Azau, Cheget and Tershol), located at about 6,560 ft (2,000 m). The cable cars extend to 12,450 ft (3,800 m), after which the ascent to the summit is nearly vertical.

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## Elburz Mountains

THE ELBURZ (or Alborz) Mountains are a narrow mountain range that curve along the southern shore of the Caspian Sea in the north of IRAN. From west to east, the range measures about 600 mi or 970 km long. The Elburz range forms a climatic barrier between the Caspian and the Central Iranian Plateau. The northern side receives a good deal of snow and rain and is blanketed by lush forests and a fertile coastal plain. The southern side, in stark contrast, has few trees and is characterized by barren brown slopes and desert below.

The Elburz Mountains and their neighboring range to the east, the Kopet Dag, were originally volcanic. They retain the verticality typical of this origin and rise almost as a sheer wall from the southern shores of the Caspian Sea. As relatively recent formations, the Elburz range is among the highest in the region and includes Iran's highest point, Damavand (18,934 ft or 5,771 m). Elburz was important in Persian mythology as a remote resting place of heroes and gods. The abrupt south face of Mount Damavand (Demavend, or Dem Âvend Kuh) towers over the city of Tehran. Other highest peaks are Alamkuh and Takht-i-Suleiman, both above 14,850 ft (4,500 m). The average peak height is 9,000 ft (2,730 m).

Numerous subordinate parallel ridges enclose fertile valleys. The main navigable river that passes through one of these and into the CASPIAN SEA is the Kizil Uzen, which joins with the river Shah south of the range, then cuts a gap through the western end of the range. This gap divides the Elburz Mountains from the Talish Mountains to the north. On the northern side of this gap, the combined rivers are known as the Safid in the few kilometers before it reaches the sea. Smaller seasonal rivers that drain off the southern slopes of the Elburz disappear through evaporation in Iran's northern Salt Desert. At the foothills of the Elburz is the most significant Iranian port on the Caspian, Bandar-e Anzali, the center of the Iranian caviar industry. It is connected to the larger city of Rasht, the terminus of rail and oil lines. At the other end of the range, the city of Bandar Torkoman lies near the frontier with Turkmenistan and has long been a trade and communications ENTREPOT between the MIDDLE EAST and Central Asia.

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## electoral geography

ELECTORAL GEOGRAPHY is a part of POLITICAL GEOGRAPHY. It is the geographical study of political space in democratic states. Electoral research in dictatorships can be useful although, their citizens are not really freely choosing. Electoral geography is therefore a special study of electoral processes and districts to map election results and then to test the results for the causes. Electoral geography as the study of election districts and the voting behavior in them has been of interest to politicians, political scientists, geographers and others since the rise of democracies in place of other forms of government in the last several centuries.

In England before the American Revolution and in the UNITED STATES since the adoption of its present constitution the practical politicians who have had the power to shape legislative districts have found that the boundaries of districts can be drawn to favor one political party over another. The American term for this is *gerrymandering*. The term was first applied to election districts drawn in the late 1700s in MASSACHUSETTS by the Federalist Party. At the time Elbridge Gerry was the governor. One of the districts looked like a salamander; however, a political wit punned the district from a salamander into a “Gerrymander.”

In England, concern with “rotten boroughs” was a concern with electoral geography and the malapportionment of the size of the districts. Ultimately, the lack of equal representativeness in districts is a concern with the legitimacy of a political system. Democratic regimes are based upon the principle of the equality of the “voters” or the people who are citizens and thus have the right to make political decisions. This means that political sovereignty of the people in elections is entailed in the shape and the demographic contents of each district. When districts are drawn by legislatures or other decision-making bodies to increase the power of one group over another, the resulting legislative or other districts become inherently unjust.

In America, the courts and ultimately the Supreme Court of the United States has tolerated political gerry-

mandering, but it has ruled as unconstitutional racial gerrymandering. Cases such as *Gomillion v. Lightfoot* (364 U.S. 339) (1960) or the cases of *Shaw v. Reno* (509 U. S. 630) (1993) and *Miller v. Johnson* (515 U.S. 900) (1995), in NORTH CAROLINA and GEORGIA respectively, have dealt with the subject. The *Gomillion* case considered racial gerrymandering in Tuskegee, ALABAMA. Ordered to allow African Americans to vote and aware that whites were greatly outnumbered, the city government gerrymandered the city’s territory from a square to a contorted figure that excluded all but about seven or eight nonwhite voters. The Supreme Court in this case was dealing with electoral geography, as it was in the recent cases of *Shaw* and *Miller*, where the Department of Justice had ordered southern states to draw some districts with African American majorities. Again the court had to rule on an issue of racial gerrymandering.

There are several ways in which gerrymandered districts are drawn. In the first approach, the goal is to populate each district with a 51 percent majority for the party in power and 49 percent district vote for the minority party. Another approach is to locate as much of the minority party’s voting strength into a few “super” districts that will be carried by huge majorities approaching 99 percent. The effect is that the minority party carries a few districts but loses all the rest and thus has a much smaller legislative representation than it would have if the election districts were drawn in a way that spread the votes of the major parties in a more competitive manner. A third approach is a combination of the first two approaches. The party doing the gerrymandering can push significant numbers of minority party voters into a few districts and then spread the rest into districts where the minority party is always outvoted. This method allows the majority party to carry a large number of seats in the legislature or parliament.

Electoral geographers study votes of plebiscites. These are often votes for constitutional amendments or some form of referendum. Studies of plebiscites focus on the spatial elements associated with the vote in order to explain why people in one area voted differently from those in another area.

Electoral geographers also study the votes of deliberative assemblies such as legislatures or parliaments. The electoral geographer then seeks to move beyond the pattern of votes cast in elections or plebiscites. The focus of these types of studies is to explain blocs of votes or to determine whether the votes are in the “best interests” of the people being represented. Studies of

votes in the United Nations and other legislative bodies can verify bloc voting. The challenge for the electoral geographer is then to interpret the descriptive results in order to explain why votes were cast as they were.

Analysis of votes of deliberative bodies is risky because the motivations for voting may be hidden in a veil of diplomacy or motives in an hidden agenda. Electoral geographers then have to move beyond the description of the votes to reveal the real causes of the voting patterns.

It should be noted that elections are conducted according to rules. These rules may be used to create the illusion of fairness in an election. Or they may be used to slant the results for the benefit of one group over another. Electoral geographers can reveal these types of machinations, but at the same time, of the approximately 200 states in the world today, less than half are democratic enough for analysis of their votes by the techniques used by electoral geographers to be meaningful.

## ELECTIONS AND MAPS

Political geographers specializing in electoral geography began to study the field as early as 1916, when E. Krehheil published a paper examining British parliamentary elections. Sixteen years later, J.K. Wright published a series of maps of the presidential elections in the United States between 1876 and 1928. In addition, he presented an introductory analysis of the maps to show the influence of northern Republican Party states and southern Democratic Party states in terms of types of farming areas and ethnic minorities.

After World War II, there was a decline in interest in political geography; however, at the same time interest in electoral geography increased. A number of studies, such as those issued by V.K. Dean in 1949 on voting in Newfoundland, stimulated an interest in the subject. Other studies were produced, such as the pioneer study in electoral geography published in 1959 by J.R.V. Prescott. In his study, "The Functions and Methods of Electoral Geography," Prescott pointed out to geographers that election statistics were of value to the discipline, but just a few such studies had been done. Prescott, an Englishman, also noted that some Europeans, especially the French, and also American political scientists were engaged in the subject.

The study of electoral geography by political geographers developed new interests in the mid-20th century with the advent of the "behavioral movement." The behavioral movement developed from the research and writing of experimental psychologists like John B.

Watson and B.F. Skinner. Watson, influenced by the studies of Ivan Pavlov, rejected the study of mental operations because these could not be observed in a public manner by a scientific observer. For Watson and other behaviorists, the mind was rejected as a private matter. Instead only publicly observable data was to be admitted as matter for scientific consideration. Skinner's experiments developed into theories on conditioning. Social scientists found that these studies were useful for studying voting behavior. For political geographers, the spatially concentrated voting data became a subject of study.

Criticism of the influence of behaviorism launched the post-behavioral movement in political science and elsewhere during the Vietnam War when opponents of the war found that empiricism did not provide grounds for opposing the war. Their criticisms were basically of two types.

First, allegedly, the studies it generated were value free and products of strict empiricism. However, critics argued that the movement described but did not prescribe when it should have. Numerous empirical studies produced data, mapped results of the analysis of elections, demonstrated the geographic distribution of different kinds of laws in the United States, and ultimately seemed to document the obvious. However, empirical data is gathered on the basis of some theory. Otherwise the researcher will not have a direction for the research project or a theory of knowledge for its analysis and integration into a science as an objective body of knowledge.

Moreover, criticism of strict empiricism observed that ultimately electoral geography was a study of values. The study of inequities in election districts or the study of the distribution of votes was ultimately a study of liberal democracies (e.g., the United States) and social democracies (e.g., SWEDEN). Modern governments are prescriptive in nature because they organize power, make decisions about who should rule, and decide who gets what, when, and how on the basis of the values of their underlying theories of human nature, of justice, of liberty, and other social values.

With data from actual elections (voting data) and statistical research on voters in areas from public opinion polling and other similar studies, political geographers could ask questions pertinent to electoral geography. They would include questions such as, Is it possible to predict political responses, given certain stimuli? How are political decisions made? What leads people to vote as they do? Can any political lessons be learned from this?

After 1960 studies in electoral geography grew more rapidly as attention was paid to spatial patterns of voting behavior in an attempt to determine underlying factors influencing voters. Other studies developed a variety of quantitative techniques for analyzing voting results. These techniques included multiple regression analysis in combination with maps, factor analysis, and correlation techniques.

### NEW ELECTORAL GEOGRAPHERS

In 1969, D.R. Reynolds and J.C. Archer tested patterns of party support in the 1967 mayoral election in Indianapolis, Indiana. They represented a new breed of electoral geographers seeking to test for spatial processes such as contagion and contextual influences. They used a complicated mathematical analysis of the vote to test for correspondence with a normal distribution. They then examined the distribution for its spatially significant deviations from randomness. They then analyzed the distribution for explanatory components and then tested them for normality and contiguity. They then applied further mathematical analysis to show that variations in the vote were explained in terms such as socioeconomic class and race.

In 1970, T.G. Glanville published his study of “spatial biases” in the votes after a federal election in the Australian state of Victoria. His study revealed two types of spatial biases. Both of the spatial biases were patterns of gerrymandering that caused the opposition to “waste” their votes.

Another aspect of electoral geography is the role of money. Elections determine who gets to control governmental spending. Studies in the late 1970s by R.J. Johnston documented how political parties in Great Britain and the United States used money to encourage political support. In his study of British elections, he documented the success of the Labour Party in the bi-elections of 1977. The success was preceded by raising the status of the marginally loyal district of Grimsby to Development Area status. The change meant more financial aid from the government for the area and seems to have been translated into votes. Johnston also studied the use of “pork barrel projects” to curry favor with voters in some districts. The term *pork barrel project* is a synonym in American politics for unnecessary and wasteful government spending for political purposes. The image is of a wooden barrel filled with salt pork (fat back) being distributed to slaves at special events in early American history. The projects that Johnston studied were distributed money by politicians who were on Congressional committees exercising

oversight of the National Aeronautics and Space Administration, the Atomic Energy Commission and the Defense Department.

Since the 1980s studies of American presidential elections have used factor analysis to research and examine multiple elections at one time. Two types of factor analysis have been used: the T-mode and the S-mode. The T-mode factor analysis combines elections over several periods of time. The analysis then shows similarities and differences between elections decades apart.

The S-mode type of factor analysis groups areas under study into regions to show similarities in areas. The United States has historically experienced sectional conflict between the southern, the northern and the western states. The S-mode type of factor analysis mathematically demonstrated the long-term influence of sectionalism in presidential elections.

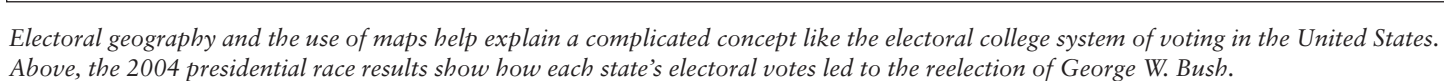
Electoral geography has come to play a significant role in American presidential elections. The president of the United States (and the vice president) are elected by electors to an electoral college. The electors vote for the president and vice president in their respective state capitals. The electors to the electoral college in all but two states vote in a bloc. They vote this way because the vote must be cast according to election laws passed by the dominant party in each of the 50 American states. The two major parties in the United States are the Democrats and the Republicans. The electoral results after an election shown on electoral maps used by the television networks have in recent times been colored red for Republican and blue for Democrats.

### RED AND BLUE STATES

After the 2000 presidential election in the United States, pundits began talking about the “red” (Republican) and “blue” (Democratic) states. These terms grew in popularity and were used by the news media to simplify speculations on the vote in the run-up to the election. There were maps easily available through the internet and in newspapers showing the vote for president. The important map was the one depicting the placement of the electoral votes in the states. These became the red and blue states.

However, maps were also easily available that showed the vote for George W. Bush (Republican) and John Kerry (Democrat) by county. There are just a little over 3,000 local units of government in the United States called counties.

In LOUISIANA, the local units are called parishes and are modeled after a French form of government, and in



While the popular vote was somewhat close, with only 3 million more votes for Bush than Kerry, the geographic distribution was revealing. Maps colored red and blue to show the vote by county showed that Bush had carried 83 percent of the counties in the United States. It also revealed that Kerry's vote was concentrated in large urban areas with heavy African American populations and in some rural counties in the southern states that have majority black populations. It also showed that Kerry carried several Native American reservations and groups of Hispanic voters, such as those on the lower Rio Grande in TEXAS.

These and other maps were quick used by pundits to explain the vote in the red and blue states in terms of ethnic, cultural, economic, educational factors, and other cultural features such as religious participation. Revealing also was the evidence that many areas voted in a manner that seemed to be opposed to their economic interests. The conclusion quickly drawn by pundits was that these were social conscience votes in support of social policies of the Republicans or the Democrats, or they were votes in support of or in opposition to the war in Iraq. The ongoing politics in America is now clearly utilizing electoral geography to make political arguments.

It is likely that attacks on the electoral college system of voting in the United States will be presented in



future decades in terms of electoral geography. The claim that voting by anything other than direct popular election is unfair is frequently urged by political opponents of the electoral college system. It causes the voters of one party in states dominated by another party to “waste” his or her ballot.

This argument is unlikely to be effective because the electoral college, like the representation in the Senate of the U.S. Congress, is weighted in favor of the “small” states. These are usually the least populated states and also those with fewer economic resources. However, the Constitution of the United States was rigged this way in the beginning to give to the small states more power than they would have had otherwise. It means that candidates are encouraged to visit most if not all states in their hunt for votes. A system of direct popular election would eliminate the need to visit most of the areas of the country. Candidates would then concentrate their campaigns on the voters in the large population areas.

Almost immediately after the 2004 presidential election in the United States there was a non-violent revolution in UKRAINE. Voting irregularities, denounced by both Ukrainians and foreign observers, eventually forced a new election that was won by the Ukrainian nationalist candidate and former Prime Minister Viktor Yushchenko. An electoral map of the first and second votes revealed the issues. The Dnieper River was the boundary between majorities of Russian speakers and Ukrainian speakers. The split was between those who wanted to return to RUSSIA and those who wanted to tie Ukraine’s future to the NORTH ATLANTIC TREATY ORGANIZATION and the EUROPEAN UNION.

Electoral geography has, through the internet, moved into the mainstream of American politics. It is now commonplace for newspapers to print maps of districts and to provide stories about electoral geography. Electoral geography is also affecting political perceptions in other parts of the world. The future for electoral geography is wide open as liberal democracy or social democracy is adopted by former totalitarian or traditionalist regimes.

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## elevation

ELEVATION CAN BE defined as a measure of the height above mean sea level. When specifying a location on (or above) the surface of the Earth, elevation is commonly considered to be the third coordinate, complementing measures of LATITUDE AND LONGITUDE. Similarly, bathymetric measurements provide a depth below mean sea level to the floor of a body of water. Mean sea level is defined as the still water level averaged over time so that periodic changes in sea level—such as those caused by the gravitational effects of the moon and sun—are averaged out.

The choice of mean sea level as the baseline (or datum) for elevation is an arbitrary, though reasonable, option. Based on the behavior of water, early practitioners of geodesy (the study of the shape of the Earth) believed that the oceans of the world were balanced by the Earth’s gravitational pull, forming a perfect sphere with the exception of the transitory distortions caused by waves and the periodic changes due to the tides.

This decision is arbitrary since elevation could have been defined as a measure of distance from the center of the Earth or a measure of distance below the highest known point on the Earth, among other possible choices. Since there is no natural zero level for eleva-

tion, collections of elevation data should be considered to be of an interval type.

Unfortunately, mean sea level is not constant at all places. There are irregularities in mean sea level because of varying concentrations of mass in different parts of the Earth, and the resultant variations in gravitational pull. Additionally, the effects of currents and differences in water temperature and atmospheric temperature and pressure create variances in mean sea level. Moreover, mean sea level is historically measured with a tide gauge, which is an instrument that uses land-based benchmarks to record the sea level. A change in mean sea level can therefore result from a change in the actual sea level or a change in the height of the land that supports the tide gauge. Given all these distorting factors, mean sea level must be considered as the zero elevation (also termed the vertical datum) for only a local area. When mean sea level has been determined for a local area, this datum is used to compute elevations in surrounding areas with surveying tools and the techniques of leveling and triangulation.

Elevation can be represented graphically in several different ways. The U.S. Geological Survey (USGS) has historically produced several map series that contain elevation data both in the form of points where known elevations have been surveyed and in the form of contour lines that produce an approximate elevation surface. Contour lines connect locations on the Earth's surface that have the same elevation value. Generally speaking, elevation contour maps use a constant contour interval (for example, 10 ft) so that the separation between contour lines represents a consistent change in elevation. This results in contour lines that are close together in areas with steep terrain, and further apart in areas with less dramatic elevation changes. The contour interval may not be constant for all maps in a map series, since the best contour interval for a given map is a function of the variation in elevation across the map and should be chosen in such a way that sufficient elevation detail can be visualized.

Although printed contour maps continue to prove useful for many applications, elevation data are increasingly processed digitally. There are several common digital formats, also known as digital elevation models (DEMs). One such DEM is termed a triangulated irregular network (TIN). A TIN begins with a set of points where the elevation has been calculated. These points can occur at any location but ought to occur at points where there is a major change in the shape of the elevation surface, such as at mountain peaks, valley floors, or the edge of cliffs. The denser the

number of elevation points, the greater the detail captured by the TIN. In order to generate the elevation surface, a set of nonoverlapping triangles are created by connecting neighboring points.

Each triangle represents a planar elevation surface, and the slope and aspect (the orientation angle of the slope with respect to north) are constant for each triangle. TINs are a very efficient method for storing elevation data, in part because they allow for variation in the density of elevation points based on variability in the elevations being mapped.

A more widely used method for digitally representing elevation data is the raster (or grid) method. A raster DEM divides a portion of the Earth's surface into regularly spaced (and usually rectangular) grid cells, arranged into rows and columns. Each cell contains a single elevation value. Based on the cell values and the values in neighboring cells, the slope and aspect can be calculated for the elevation surface. The raster method allows for easier manipulation of elevation data than the TIN method, although it requires greater amounts of computer disk space to store the large number of regularly spaced elevation values. Rasters are always regularly spaced, so there is no way to vary the density of elevation observations within a single raster to account for greater or lesser variability in relief. High-quality DEMs in raster format are available at several different cell resolutions.

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## enclave

AN ENCLAVE is a political unit that is completely enclosed within a foreign territory. It is called an "exclave" from the perspective of the country that has sovereignty over it. An enclave can also exist on a subnational level when a subdivision has land outside its parent territory. The enclaves can be created for geological, historical, or political reasons. *Enclave* is a French word of the diplomatic language, which passed into the other languages; it comes from the Latin *in-clavatus*, meaning "closed with the key."

Some enclaves are small nations completely surrounded by another one, for example SAN MARINO and VATICAN CITY, exclaves of ITALY, and LESOTHO, exclave of SOUTH AFRICA. Some nations can be enclaved except for a small part of the coast, as in the cases of GAMBIA, BRUNEI, and MONACO. Some other territories cannot be reached from their nation except by international waters, or are enclosed in other countries except for a small coast fragment: This is the case of the Spanish towns of Ceuta and Melilla in the north of MOROCCO and of the British colony of GIBRALTAR in the south of SPAIN. True enclaves are the Belgian municipality of Barle-Nassau in the NETHERLANDS; Busingen in GERMANY (exclave of SWITZERLAND); Campione d'Italia in Switzerland (exclave of Italy); and the town of Llívia in Spain (exclave of FRANCE). Madha is a land of OMAN enclaved in the UNITED ARAB EMIRATES; INDIA has 106 exclaves in BANGLADESH and Bangladesh has 92 exclaves in India.

A lot of enclaves in history do not exist anymore. Until 1861, the Pontifical State had the exclave of Benvento in south Italy, and the Papal States also had the exclave of the Comtat Venaissin, the region around the city of Avignon, enclaved in France, from 1274 until 1791. HONG KONG, until 1997 administered by Great Britain, now is part of CHINA. There are territories that are not true enclaves, but are practically. Some practical enclaves are not geographically detached from their nation, but are more easily reached by entering another country because of their location. Some villages of ESTONIA, for example, can be reached only by a road passing inside Russian land.

The more frequent type is the subnational enclave. Administrative division of countries, often for historical reasons, can create small lands enclaved in another province, region, or municipality. In AUSTRALIA, the Australian Capital Territory is an enclave of New South Wales. In AUSTRIA, Vienna is an enclave of Lower Austria. In COLOMBIA, Bogotá is an enclave of Cundinamarca.

Other examples include: In Belgium, the Brussels-Capital Region is an enclave of Flanders, and also the capital of Flanders. In Italy, a lot of municipalities have exclaves: Città di Castello, in the region Umbria, has the exclave of Mount Ruperto enclaved in the territory of the Marche region.

Ethnic enclaves are communities of an ethnic group inside an area where other ethnic groups are the majority. The historic Jewish ghettos in Europe and the Native Americans reservations in the UNITED STATES are some examples.

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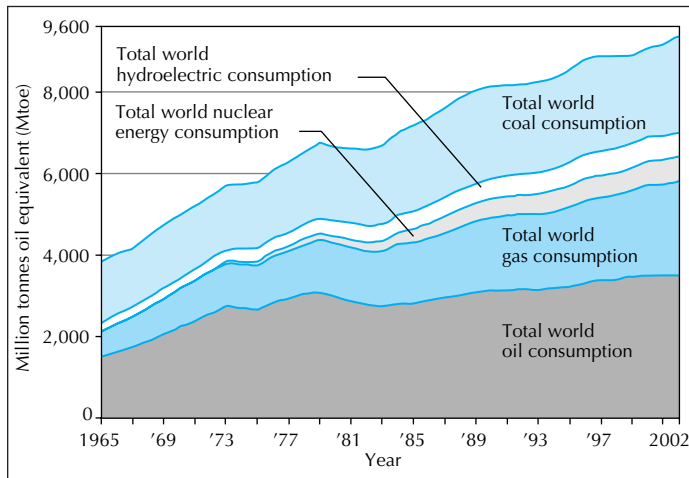
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## energy geography

ENERGY GEOGRAPHY IS a subdiscipline of geography that draws from many philosophical and thematic traditions, but it is primarily positioned in the interface of environmental and economic concerns. The extraction, harnessing, and consumption of the natural resources that supply society with our energy needs have always been central to economic activities. Over time, however, it has also become apparent that we face scarcity of resources and negative consequences of pollution, and the environmental component of energy analysis has grown stronger. As such, the focus on energy in geography is important because it addresses one of the central aspects of the discipline—the human-environment interaction.

Energy can be defined as the capacity for, or equivalent of, doing work. Society needs energy for transportation, heating and cooling of buildings, powering production processes in industry, and various household needs. Sources of energy are classified as renewable or nonrenewable. Nonrenewable is primarily fossil fuels: oil, coal, and natural gas. More than 80 percent of U.S. energy needs are satisfied by fossil fuel. Renewable energy sources include hydro-electric, solar, and wind power. Nuclear power occupies a special position not commonly classified as either renewable or non-renewable. Often, the energy source itself has to be converted to a usable form. The most common and versatile form is electricity, which is generated in coal-fired power plants, nuclear plants, or hydroelectric dams. In the transportation sector, gasoline and other oil derivatives directly power the combustion engine. Another example of this direct use is when natural gas is utilized for home heating.

Energy geography may not be as well defined as economic or cultural geography. For example, courses in energy geography are infrequent in geography departments around the country, although energy issues



Energy geography is about the distribution and consumption of fuel resources around the world. (Source: British Petroleum)

are often addressed in other forums. Geographers' interest in energy has mirrored the developments in society at large. With the advent of the environmental movement in the 1960s and 1970s, and the subsequent oil crisis and surging energy costs, energy studies became increasingly popular in the 1970s in geography as well as in the research community in general. After the immediate crisis, energy concerns were not prioritized, but socioeconomic and technical solutions continue to make our energy system more efficient. There is still much work to be done, however, and in this endeavor, geographers can be found not only in academic departments but also in government agencies and laboratories and in private industry.

What, then, is the geographic perspective on energy? Inevitably, society's energy use has spatial dimensions and impacts. Here is a selected list of themes of concern to energy geographers:

First, energy geography is about the distribution of resources over space. The global location of natural resources such as oil, gas, and coal sets the parameters for our energy needs. The location of fossil fuel is determined by geology, but the potential for renewable energies also exhibits spatial variation because of geomorphic (hydroelectric) and climate (solar and wind) factors.

The extraction of energy-generating resources and their strong concentration in some areas has led to regional economies being heavily dependent upon energy industries. Such dependency can lead to large profits, but also fluctuations in income as raw material prices are volatile on the world market. Resource extraction

may not produce diverse and stable long-term regional economies. Access to strategic energy resources, particularly oil, can also have geopolitical ramifications.

The harnessing of energy for human purposes has environmental and social impacts on the supply side. Hydroelectric power, although emission-free, has land-use impacts as dams inundate large areas and irreversibly alter river hydrology, riparian vegetation, and habitats. Moreover, the people reaping the benefits of hydroelectric power are not necessarily the same (or located in the same place) as those who are impacted negatively (those displaced). Wind power is facing related problems on a smaller scale; in this case, wind generators detract from the scenic aspects of the landscape. In addition, coal mining creates the problems of acid mine drainage and strip mining, while oil drilling can create leakage and contamination of the local environment.

The geographic difference between resource location and energy demand necessitates transportation and distribution. The transportation of oil on ocean-going vessels has frequently led to devastating oil spills. Distribution systems like pipelines also trigger environmental concerns, and like power lines, the construction of such networks is often opposed by residents and localities in their proximity.

Then there are environmental and social impacts on the demand side. The effects of the energy conversion or consumption process result in emissions, particularly gaseous air emissions. Pollutants include various forms of sulfur, nitrogen, and carbon oxides with environmental effects such as smog, acid rain, and global warming. Adverse human health effects (respiratory problems and cancer, for example) may also ensue.

Nuclear energy production, on the other hand, creates a particularly severe waste issue. Finding a solution to radioactive waste storage is a locational problem that spans geography and politics.

Such environmental problems are not inevitable or unavoidable. Geographers have therefore been interested in the spatial organization of energy systems. The UNITED STATES, for example, has the highest per capita energy consumption in the world. This high consumption level is, in part, a result of the sprawling nature of settlement patterns. To achieve a more sustainable society, it has to be spatially organized so as to enable recycling, minimize energy consumption, and utilize renewables, while at the same time allowing for a reasonable level of economic growth. One problem is that the environmental consequences of our actions are often "hidden" as we as individuals are not immedi-



ately impacted. Concepts developed to illuminate such relationships include the ecological footprint idea and life-cycle analysis. We must also take into account human behavior and our consumption choices when it comes to energy use.

Geographers can contribute to efficient and equitable energy systems by critiquing and suggesting energy policy. This includes conservation efforts and highlighting social consequences of policy making. We are currently dependent on fossil fuels and the infrastructure built to support it, but a transition to other energy sources, including perhaps hydrogen- and biomass-based fuel technologies, will inevitably occur during the 21st century.

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## entrepot

AN ENTREPOT (from the Latin *emporium*) is a settlement founded specifically for commercial activity or a market or mart located within or on the periphery of an administrative/political center. The origins of the entrepot are traced to the commercial behavior of ancient societies.

Traders entering foreign territory were exposed to numerous natural and cultural hazards. In addition to facing harsh traveling conditions, they might be attacked by brigands or find themselves in places where they did not know the local languages or customs and were subject to territory-specific laws under which they would find no protection. Foreign merchants required neutral sites of exchange, which would offer provisions, lodging, interpreters, and legal and economic

safeguards. Designated, controlled trading stations met the needs of the host society as well. Restricting stranger merchants to an entrepot protected the local population from potentially threatening foreign influences. Moreover, elites could use control over the flow of prestige commodities, such as items of precious metal, to maintain their social position, redistributing the imported goods locally through processes of gift exchange.

Entrepots for foreign exchange were generally located at the boundaries dividing political territories or distinct economic or environmental zones, such as the SAHEL of Sub-Saharan Africa, which lay between the desert and the savannah. Situated along TRADE ROUTES, the entrepot had to be accessible to foreign merchants—for example, a place with a functional harbor—which in turn was connected to inland distribution networks. Because the entrepot also provided lodging and provisions to visiting traders, who might spend long periods there before returning home, nearby supplies of potable water and an agricultural HINTERLAND also were important.

The population and administrative organization of the entrepot varied with its function and complexity. Whether a seasonal market or year-round point of exchange, a site required a permanent population to maintain it. The permanent service population would consist either of locals or of permanent representatives of a foreign trading diaspora, who would learn the territory's language, look after the foreign community's temples, and cultivate relations with the host society.

If the entrepot had an ethnically and linguistically mixed population, it would be divided into distinct residential neighborhoods. Craftsmen resided at the entrepot as well, producing not only goods for exchange but also producing and repairing gear needed by the traders—everything from combs and shoes to ships and carts. Finally, port officials collected tolls and adjudicated disputes.

Extensive entrepot networks arose with the intensification of long-distance trade throughout the Mediterranean and Near East in the first millennium B.C.E. The network in classical Greece (5th to 4th centuries B.C.E.) consisted of two types of entrepot (Greek *emporion*): harbors attached to but separated from a polis (city) by walls (for example, Athens's harbor, the Piraeus); and permanent Greek commercial colonies located on the periphery of the Greek world (for example, Naukratis in Egypt). The first type funneled commodities in and out of Greek cities. The second acted as an interface between the Greek world and non-Greeks, giving the

Greeks access to metals and other raw materials that were not available in the Greek home territories.

The Romans developed extensive networks of entrepôts, linking their resource bases in northwestern Europe, northern Africa, and the Near East with INDIA's Malabar Coast, and the SILK ROAD, extending across Central Asia to CHINA via a system of desert emporia (caravanserais). Following the collapse of Roman control in northwestern Europe, the Frankish and Anglo-Saxon kingdoms established their own emporia trading networks along the coasts of the North and Baltic seas in the 7th and 8th centuries (for example, LONDON, Dorestad, Cologne), which quickly spread to Scandinavia and RUSSIA.

This period also witnessed the formation by the Islamic caliphates of entrepot networks along the coasts of the INDIAN OCEAN, which acted as interface points with non-Islamic peoples for the acquisition of slaves, spices, and other luxury items from Africa, INDONESIA, and China. In the first half of the 16th century, however, Portuguese and, later, English and Dutch trading corporations assumed control of the Indian Ocean and Southeast Asian entrepôts. Here, the host communities eventually lost control of the trade and actions of the foreign merchants, with European traders coming to control not only the entrepôts but the adjoining hinterlands and their resources as well.

The integration of the global economy during the last two centuries has transformed the character, but not the function, of the entrepot. International trade now takes place in multifunctional centers, such as the financial and administrative metropolises of NEW YORK CITY and London. Entrepot is now used to describe distribution points within cities, such as warehouses.

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## epidemiology

THE WORD *EPIDEMIOLOGY* is derived from the Greek *epi* ("upon"), *demos* ("people"), and *logos* ("study

of"). It refers to the study of phenomena that have been put "upon" people, specifically, afflictions that weigh upon the health of a population over space and time. Epidemiology is a multidimensional science that deals with the study and occurrence of diseases, attempting to answer many questions: the origin, causes, loci, and spatial distribution of diseases and how these aspects have changed over time. To answer these questions, epidemiology often takes a historical perspective and borrows from the fields of medicine, ecology, anthropology, sociology, and demography. Geography is involved because the spread and spatial patterns of diseases are analyzed.

Epidemiology in the Western world can be traced back to the ancient Greek civilization, where Hippocrates (460–388 B.C.E.) laid the foundations for modern epidemiology through observation and description of diseases in relation to the environment. Sporadic references to epidemiology occur throughout history, such as references to links between illnesses and environment, and between public health and sanitation. Scientific inquiry gained ground by the 17th century, and like other sciences, epidemiology has shifted its theoretical allegiance many times since.

Early epidemiological studies were descriptive in nature, detailing disease symptoms, areas of influence and affected population groups and subgroups. Causes were often speculated upon based on the reigning belief structure. In the 18th century, cause was often based on the miasma theory (diseases borne by air). The 19th century saw the popularity of the germ theory, which focused on the role of microorganisms in causing and spreading disease. Currently, epidemiologists believe that a number of factors (for example, environment, microorganisms, genetics) play into creating diverse disease patterns.

John Snow, a 19th-century London physician, performed one of the first formal epidemiological studies in modern history, which has since become a legend. London had been ravaged by cholera, but the cause was yet unknown. As for all contagion in the day, miasmas were believed to be the culprit, but Snow suggested that the disease spread through contamination of food and water by way of the water supply. He was finally able to validate his theory during London's 1854 epidemic by mapping the locations of cholera deaths and of water pumps in the city. He found that the Broad Street Pump showed the greatest concentration of deaths near it. He suggested the removal of its handle, which, incredulously for the townspeople at the time, resulted in a containment of the epidemic.

This exercise demonstrated the importance of sanitation and prevention measures in the containment of diseases and epidemics, a lesson used even today.

It would be erroneous to believe that epidemiology is a Western science. “Non-Western” or traditional civilizations present evidence of epidemiological studies that predate even the work of the ancient Greeks. Careful observation of symptoms and possible causes had been noted in the civilizations of EGYPT, CHINA, INDIA, and the Americas. Treatises such as *Charaka Samhita* by the Indian physician Charaka, and Zhubing Yuan Hou Lun (*On Pathogenesis and Manifestations of All Diseases*) by the Chinese physician Chao Yuanfang were written, which contributed greatly to the development of epidemiological studies and the promotion of public health. Sadly, much of this was lost, downplayed, or overshadowed by Western knowledge and paradigms.

Some of the benefits derived from epidemiology are a better understanding of the causes and etiology behind illnesses and health problems; the impact of changing technologies, environments, and lifestyles on our health; the ability to project longevity and morbidity patterns on the basis of this understanding; the ability to provide prognoses and generalizations; and finally, the provision of solutions through prevention and public health measures.

These uses are evident in the case of AIDS (acquired immunodeficiency syndrome), which was first identified only in isolated cases in the early 1970s but has now become a pandemic (global epidemic). Through epidemiological studies, it is now known that AIDS is primarily caused by the human immunodeficiency virus (HIV). Two strains of this virus exist, one originating in Central Africa and the other in West Africa. Both have diffused over travel routes to other parts of the world.

Epidemiology has revealed the nature, origin, diffusion routes, and modes of transmission (blood and blood product transfusions, sexual contact, needle sharing, and mother-to-child) of AIDS. Early identification of symptoms and risk factors, more accurate prognosis, and identification of geographic patterns of occurrence are instrumental in containing its rapid spread and in formulating effective health programs.

The descriptive style of traditional epidemiology has been replaced by a more complex set of theories and methods comprising the current modern approach, which uses statistical techniques and models. However, epidemiology’s status as a true science is often questioned on the grounds that it lacks a theoretical matrix.

However, epidemiology does claim underpinnings such as the “agent-host-environment” triad and “iceberg” concept. “Iceberg” is an analogy that describes a widely occurring phenomenon in healthcare, that of undiagnosed or misdiagnosed cases being hidden from view, much like the unseen portion of an iceberg. These theories are subject to the rigors of testability through the use of appropriate measures and tools. Some commonly used methods and tools are cohorts, case-control studies, and rates and ratios.

As epidemiology advanced, it became apparent that diseases were affected by geography, in terms of both absolute location and what was contained within that location. This realization of areal variation of diseases contributed to the legitimization of medical geography as a field of study in its own right.

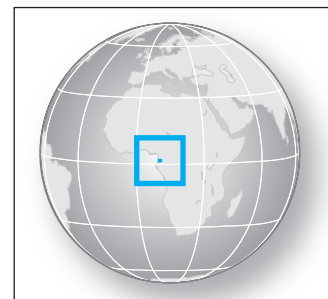
Two approaches evolved: disease ecology and disease diffusion. Disease ecology deals with the interplay among environmental conditions (physical and social), the human host, and the agent of the disease. Disease diffusion examines the spread of diseases from their points of origin. An integrated approach is probably the best means to a complete “picture of health.”

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## Equatorial Guinea

**Map Page** 1115 **Area** 10,831 square mi (28,051 square km) **Population** 510,473 **Capital** Malabo **Highest Point** 9,870 ft (3,008 m) **Lowest Point** 0 m **GDP per capita** \$4,900 **Primary Natural Resources** petroleum, wood uranium, gold, manganese.



EQUATORIAL GUINEA is located in west-central Africa just north of the equator. It is made up of Rio Muni on the African mainland and the islands of Bioko, Annobon, Corisco, Elobey Grande, and Elobey Chico. Rio Muni is bordered by CAMEROON to the north and by GABON to the east and south. The Campo River forms part of the northern boundary with Cameroon, and the Rio Muni River forms part of the southern boundary with Gabon. These two rivers, along with the Mbini River, located in the center of Rio Muni, are the three largest rivers in the country.

Rio Muni contains 93 percent of Equatorial Guinea's total landmass, and 80 percent of the population lives here. The major urban areas in Equatorial Guinea include Malabo and Luba on Bioko Island and Bata, Mbini, Ebebiyin, Mongomo, and Evinayong on the mainland of Rio Muni. Both Bioko and Annobon islands are volcanic. Equatorial Guinea has a tropical climate that is hot and humid year-round. Along the coastal plain, the city of Bata is cooler and drier than the rest of the country. Rio Muni is mainly hilly terrain averaging about 2,000 ft (610 m) in elevation with some 4,000-ft (1,220-m) peaks.

Bioko Island, which was called Fernando Po until the 1970s, lies about 25 mi (40 km) from Cameroon and is the largest island in the Gulf of Guinea, covering 780 square mi (2,017 square km). It was discovered in 1471 by Portuguese explorer Fernando Póo, who was seeking a route to INDIA. PORTUGAL controlled the island until 1778, when it ceded this, surrounding islets, and commercial rights to the mainland between NIGER and the Ogoe River to SPAIN in the Treaty of Pardo in exchange for territory in South America (mainly territories in BRAZIL). Bioko is made up of three extinct volcanoes, the largest of which, Pico Basile, reaches up 9,870 ft (3,008 m). The coastline is 120 mi (195 km) long, very steep to the south from the volcanoes rising up, and much lower in the northwest, with good harbors at both Malabo and Luba.

Also along the northwestern coast between Malabo and Luba are several scenic beaches. Indigenous to Bioko Island are the Bubi people constituting 15 percent of the population. The Bubi are descendants of slaves liberated from western Africa by the British during the 19th century.

Originally, it is believed that the first inhabitants of Equatorial Guinea were Pygmies who still live in isolated areas of northern Rio Muni. The majority of the people of Equatorial Guinea are of Bantu origin, most of these being from the Fang tribe, which makes up 80 percent of the total population of Equatorial Guinea.

Spain granted Equatorial Guinea independence on October 12, 1968. After gaining independence, they suffered for 11 years under a repressive dictatorship that suppressed the local economy. Equatorial Guinea's economy was mainly based on developing the rich volcanic soil for agricultural use. They grow cocoa, coffee, plantains, cassavas, sweet potatoes, and palm oil. They are slowly developing their fishing industry with the help of Spain, NIGERIA, and MOROCCO. Oil and gas discovered offshore is now the main export and will continue to drive the economy for years to come.

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## erg

THE TERM *erg* is the Bedouin name for a very large body of sand dominated by sand dunes. Bedouins are an African tribe of nomadic herders living in the northern SAHARA DESERT. Two equivalent English-language terms are *sand sea* and *dune field*. Transverse dunes typically are part of ergs, or sand seas. As sand is seemingly everywhere, the dunes appear as waves in a sea of sand. Hollywood made this sandy landscape famous in classic movies such as *Lawrence of Arabia*, in which sword-wielding Arab horsemen galloped across seemingly endless seas of velvet-soft dunes. Contrary to popular belief, ergs are usually not continuous deposits of fully formed dunes; small inter-dune exposures of underlying bedrock, soil cover, or deposits of ephemeral lakes and streams are common.

Ergs require huge supplies of sand. The sand of an erg is usually from nearby dry lakebeds, ALLUVIAL FANS, smaller dune fields, remnants of earlier sand seas, or coastal dunes. The Namib erg, which stretches along the southern coast of Africa, receives its sand from nearby coastal dunes. Some ergs are surprisingly far from their sand supplies. This fact is especially true in the Sahara Desert of northern Africa, where sand may flow thousands of kilometers before entering a sand



sea. Wind patterns will also affect sand supply. For instance, dunes in southern Africa and AUSTRALIA tend to be linear and form whorls (or wheelrounds) that stretch outward from their central areas. These whorls indicate an counterclockwise movement of sand in response to continental anticyclones that dominate the two regions. Topography also affects sand supply. For instance, several ALGERIA sand seas occur close to upland areas, where the uplands extend across the regional trend of sand drift. Some of the more striking sand seas occupy topographic basins. The Simpson in Australia and the Taklimakan in CHINA are examples.

Ergs or sand seas are impressive for their areal coverage. There are major ergs in northern Africa, southern Africa, the Arabian Peninsula, Central Asia, PAKISTAN, and China. The largest contiguous erg covers 1 million square mi (2.5 million square km) in southern Africa's KALAHARI DESERT. Natural vegetation has stabilized most of this sand sea. The largest active sand sea is RUB AL KHALI in SAUDI ARABIA, which stretches across 220,000 square mi (560,000 square km). The region with the greatest number of ergs is northern Africa's Sahara Desert; it has 27.

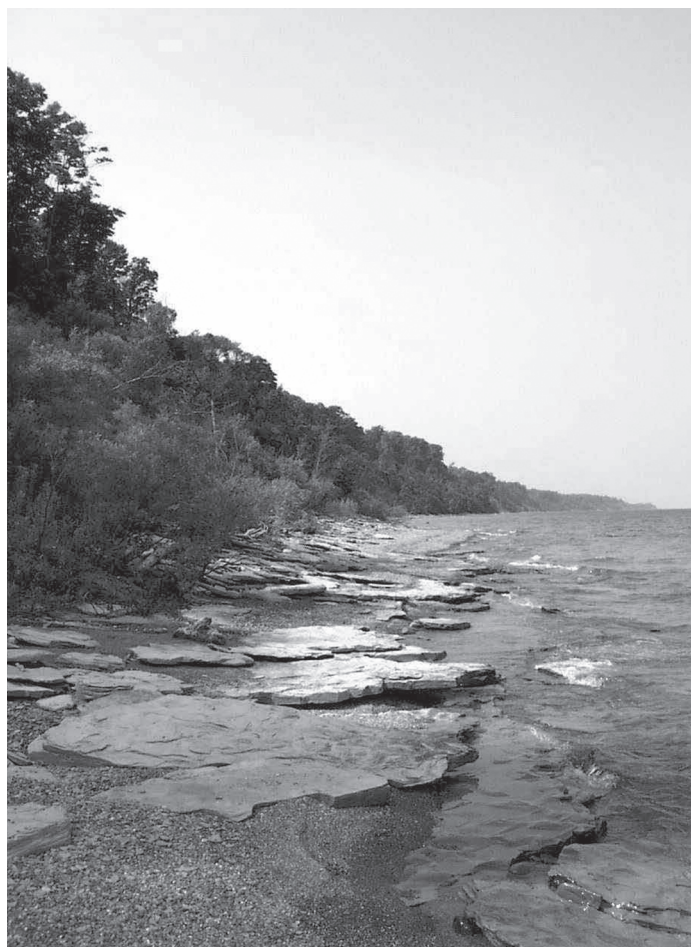
The proportion of the world's deserts covered in sand varies greatly. AUSTRALIA's large desert is the sandiest, more than 50 percent of it under sand. North American deserts' 2-percent coverage makes that continent's deserts the least sandy. North America has no ergs as a result. The continent's largest dune fields—the Algodones in CALIFORNIA, White Sands in NEW MEXICO, and Great Sand Dunes in COLORADO—are too small to qualify as ergs.

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## Erie, Lake

LAKE ERIE, bordered by the province of Ontario in CANADA to the north, NEW YORK to the east, PENNSYLVANIA and OHIO to the south, and MICHIGAN to the west, is the shallowest of the Great Lakes at only 62 ft (18.9 m) and it remains the smallest in volume. Lake Erie is 241



*After decades of pollution, Lake Erie's ecosystem has returned to a more stable state with some fish reappearing in its waters.*

mi wide (380 km), and 57 mi (91 km) from north to south and has 871 mi (1,401 km) of shoreline. Because of its shallowness, Lake Erie is the warmest of the Great Lakes in the summer, meaning it is the most biologically productive, and during the winter, it is the only lake out of the Great Lakes to freeze. Lake Erie is one of the five large freshwater lakes in North America. The other lakes surrounding Lake Erie are Lake SUPERIOR, Lake MICHIGAN, Lake HURON, and Lake ONTARIO. Eighty percent of the lake's water flows in through the Detroit River, carrying water from lakes Superior, Huron, and Michigan. Lake Erie is the most heavily populated freshwater BASIN in the world. There are 17 metropolitan areas within the basin.

Ecological problems have threatened this site more so than any other of the Great Lakes. Historically, this lake was used moderately by Native Americans for food and water. Later, when the Europeans arrived, they found a somewhat stable ecosystem that remained

so mainly because of the Europeans' interest in animal furs. However, that all changed when the large influx of immigrants arrived and began to utilize the land for agriculture and the water for fisheries. Industrialization and urbanization soon followed slowly lowering the quality of the water. Some of the many prominent problems was bacterial contamination, putrescence, and floating debris in the water. This undoubtedly led to diseases such as typhoid fever being contracted by people exposed to the water.

In the 1950s, Lake Erie also was the first of the Great Lakes to display lake-wide eutrophic imbalance. Eutrophic imbalance refers to the imbalance of minerals and nutrients that promote proliferation of plant life in lakes and ponds. This was present because of the high levels of phosphorus output by factories in the very highly populated Lake Erie basin, and it had dire consequences on the lake's ecosystem. Depleted oxygen levels were found along with excessive algal growth and the disappearance of entire families of fish.

The 1960s brought growing public concern regarding the state of the lake's water. Lake Erie was actually called the dead lake by the press. It evolved from a stable ecosystem to one very much affected by artificial fertilizers used by the surrounding farmers, waste from the surrounding communities, and factory waste. Floating waste, putrescence, and bacterial contamination were all of great concern to both the U.S. and Canadian governments.

This concern brought much needed government measures to stabilize the lake's ecosystem. Greater investment in pollution research by the U.S. and Canadian governments and efforts to regulate the toxicity and level of waste being released by the factories began in earnest.

In 1987, the United States and Canadian governments signed the Great Lakes Water Quality Agreement (GLWQA) to develop a management plan for the Great Lakes. More specifically, under the GLWQA, they created the Lake Erie Lake-Wide Management Plan (LaMP), which included efforts from local, municipal, state and federal offices in the four surrounding states of Michigan, Pennsylvania, New York, and Ohio and the province of Ontario. The four subcommittees within the LaMP are; Beneficial Use Impairments, Sources and Loadings, Ecosystem Objectives, and Public Involvement.

Thanks to the efforts made by both the American and Canadian governments, Lake Erie's ecosystem has returned to a more stable state with lower phosphorus output levels, and it appears as if the eutrophic imbalance

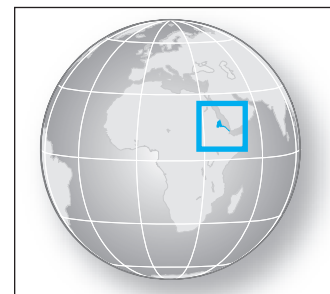
is being adequately dealt with by the governments as some species of fish have returned to the lake.

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## Eritrea

**Map Page** 1114 **Area** 46,662 square mi (121,320 square km) **Population** 4,362,254 **Capital** Asmara **Highest Point** 9,959 ft (3,018 m) **Lowest Point** -248 ft (-75 m) **GDP per capita** \$700 **Primary Natural Resources** precious metals, natural gas.



ERITREA IS LOCATED in northeastern Africa, an area known as the HORN OF AFRICA, where the RED SEA empties into the INDIAN OCEAN. Eritrea is bordered to the south by ETHIOPIA, which until 1993 incorporated Eritrea within an autonomous zone, to the west by SUDAN, and to the southeast by DJIBOUTI. Among these neighbors, Eritrea shares much geography and climate, particularly with Ethiopia.

In particular, the Red Sea and Indian Ocean determine much of the country's weather. Likewise, a large central highland plateau extends northward from Ethiopia and helps to moderate Eritrea's temperatures. These highlands are generally wetter and cooler than the coastal lowlands to the east or the plains to the southwest. The country's major population settlements are concentrated in these temperate highlands. Eritrea has two rainy seasons, with the first and heavier occurring during the summer and the lighter one in the spring.

Eritrea was dominated by other larger powers, falling under the sway of first the Egyptians, Ethiopians, and finally the Italians. In 1869, imperialists purchased the southern port of Assab and quickly expanded their holdings with further purchases northward to Massawa. Italian colonialists confronted the Ethiopians, which after 1889 led to the Italians ex-

panding into northwestern Ethiopia. Subsequently, the Italians launched an invasion of Ethiopia from their colony Eritrea but were decisively defeated at the Battle of Adowa in 1896. This defeat led the Italians to concentrate on developing Eritrea for its economic and strategic importance. In 1935, the Italians attacked and conquered Ethiopia, merging the two colonies until the British defeated the Italians in 1941. At the end of the war, the United Nations assigned Eritrea to Ethiopia, making Eritrea an autonomous region within Ethiopia in 1952. Relations frayed as the Eritreans demanded their independence. The Ethiopians dissolved the autonomous zone and annexed Eritrea in 1962, sparking 30 years of Eritrean armed struggle.

In the late 1970s and through the 1980s, the situation dramatically improved for Eritrea. First, domestic opposition groups in Ethiopia launched an insurgency against the Ethiopian regime. Second, the Eritrean People's Liberation Front made significant headway on the battlefield, driving the Ethiopian military from most of Eritrea by 1988. Shortly thereafter, the Soviet Union ceased its military aid to the regime, denying the military equipment necessary to pacify Eritrea and fight the Ethiopian insurgents. In 1991 the regime crumbled, ending the hostilities and granting Eritrea its independence. Tensions remained, however, and in 1998 the two states clashed again in a brutal border dispute that ended with a peace treaty in 2000.

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## erosion

**EROSION HAS MADE** huge changes in the surface of the Earth and is still doing so today. Erosion is the removal of materials from the Earth's surface by a variety of processes. The material is eventually deposited elsewhere, often far from where it started. Most erosion is caused by the action of wind, water, or ice. Water causes the most erosion. Weathering is the breaking down of rock into smaller particles. Erosion differs from weathering in that erosion involves something moving—wind, rain, or a glacier.

During the natural process of erosion, the landscape is changed over thousands or millions of years. Mountains are worn down, valleys are filled in, and rivers change their courses. These changes are gradual, but many of the practices of man speed up the process of erosion and cause serious problems around the world. Construction is one of the biggest culprits. Topsoil, minerals, and nutrients are lost from every construction site. About 80 percent of the erosion in FLORIDA is due to manmade activities. Cutting the forests and plowing the land has also contributed to erosion of the land.

Human activities cause topsoil to be lost, along with the minerals and nutrients it contains. This affects agriculture. Erosion causes ugly gullies in the landscape. Materials from water erosion can clog culverts and streams. Recreational areas and residential areas are damaged by erosion. Wildlife may be destroyed and its environment altered to the point that it can no longer support wildlife.

Water erosion includes stream erosion, beach erosion, and erosion by flooding. Stream erosion is most common. Streams carry sediment from one place to another. The amount of sediment carried and the amount dropped depend on the speed of the water. Water speed is affected by many factors, including the steepness of the slope and the shape of the channel through which the stream flows. The faster the water moves, the more material it can carry, and the larger particles it can move. When water goes around a bend, sediment is removed from the outer part of the bend and swept downstream. Water flows more slowly on the inside of the curve, so sediment accumulates here as it is dropped by the slowing water. Valleys eroded by streams are V-shaped, as opposed to the U-shaped valleys eroded by glaciers.

Heavy rains in spring can increase the velocity of a stream and cause more erosion to take place. Sandy ground erodes more easily than rocky ground. At its most extreme, stream erosion has created wonders like the GRAND CANYON. This vast canyon was eroded by the Colorado River, although some scientists now believe other rivers helped cut the canyon. The canyon, which is 227 mi (446 km) long, averages 4,000 ft (1,219 m) deep. Its deepest point is 6,000 ft (1,829 m) and the widest point spans 15 mi (24 km). This erosion took place over a period of millions of years.

Beach erosion occurs along ocean shores and can be caused by natural phenomena or by humans. Natural phenomena that can cause beach erosion include currents, storms, earthquakes, winds, waves, and tides.





*Coastal erosion can cause millions of dollars in property damage, as shown after a coastal storm in Australia.*

The gradual movement of the Earth's tectonic plates can also cause beach erosion.

Unlike stream erosion, which takes place over a period of many years, beach erosion can be immediate. This is especially true in the case of a storm. However, even in calm weather, sand may be pulled out into deeper water, causing it to be lost from the beach. Loss of sand is significant, since the beach both protects the land behind it and provides recreation areas and habitat for wildlife. The beach absorbs energy from the sea, and the wider the beach is, the more energy it will absorb before the waves reach landward developments. So when sand is washed away, making the beaches recede, more damage is likely to be done to houses and developments.

Global warming also has its effect on beach erosion. It causes the sea to warm up and the polar ice caps to melt. This raises the level of the oceans, causing more erosion.

Many houses in Florida have been built too near the beach and erosion has put them at risk. The Cape Hatteras Lighthouse on the Outer Banks of NORTH CAROLINA is another example of buildings endangered

by erosion. When the 4,800-ton (907-kg) lighthouse was built in 1870, it was 1,500 ft (457 m) from the ocean. By 1999, the beach had been eroded to within 150 feet (46 m) of the structure. The Cape Hatteras Lighthouse was moved a quarter of a mile (.4 km) inland from its former site.

In MASSACHUSETTS, Cape Cod's oldest lighthouse, the Highland Light, is also threatened by beach erosion. The ATLANTIC OCEAN is 400 ft (122 m) closer than it was when the lighthouse was constructed in 1797. And in just the seven years between 1997 and 2004, 40 ft (12m) of beach disappeared because of harsh winter storms. The lighthouse now stands just 100 feet (30.5) from the water. The Army Corps of Engineers is in the process of moving the Highland Light, a \$1.5 million project.

### SEA WALLS

Man has tried to curtail beach erosion in several ways. Seawalls have been built off the shore. However, the walls reflect the wave energy back to the sea, and that accelerates erosion. Also the beaches don't get the sand that is usually eroded from the bluffs along the shore. Groins, which are rock walls built perpendicular to the beach, have also been tried. The sand will gather on the updrift side of the wall. The currents carrying sand are slowed down and slow-moving water can't carry as much sediment. The result is more sand on the updrift side, but it is removed from the downdrift side. Jim O'Connell, a coastal processes specialist at Woods Hole Oceanographic Institute, points out that the coastline is "all one linked system. If you alter one area, you will be causing an alteration in another."

On some beaches, restorers have tried pumping sand, obtained from deep waters, onto the beaches. It works for a while but is expensive. Robert Dalrymple, a civil engineer at the University of Delaware Sea Grant program calls it the "method of choice these days."

### BREAKWATERS

Building offshore breakwaters is another possible solution. These are long heaps of rocks dumped parallel to the shore to intercept waves. "Depending on how they are used, they will do fine," Dalrymple explained, but he also pointed out that visible breakwaters can be an eyesore. He says a submerged breakwater may be the solution, but details of where and how to build them have not yet been worked out.

Flooding can also cause erosion, and vice versa. When water overflows the banks of a river or lake, it can erode the land it covers. Flooding is also more



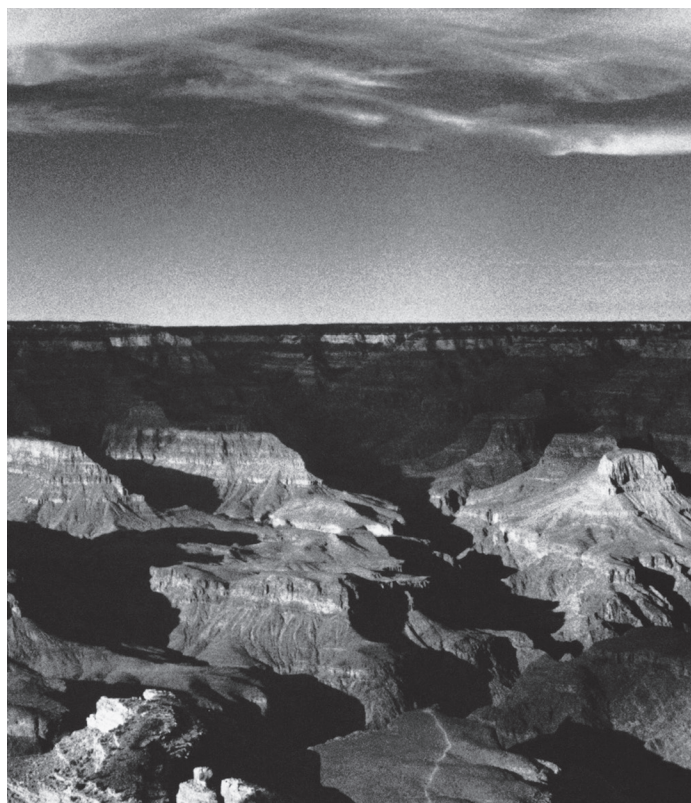
likely to occur where land at the edge of a river or lake has eroded away. Spring thunderstorms sometimes cause surface runoff and create large gullies when streams overflow their banks. Some flooding can be prevented. Flood prevention measures include digging drainage ditches, planting ground cover, constructing tile drains, creating and preserving wetlands, and building dams and levees.

Related to water erosion is erosion caused by ice. Most erosion by ice occurred during the Ice Ages, when the glaciers moved huge amounts of soil and rock. Hundreds of lakes were created as the glaciers moved slowly across the Northern Hemisphere. Glaciers also built up landforms when they melted, depositing rock, soil, and other materials. Most glacial erosion occurred during the Ice Ages, but glaciers still exist in ANTARCTICA, GREENLAND, CANADA, NEW ZEALAND, CHILE, and the northwestern UNITED STATES.

Another form of ice erosion occurs each winter when water trickles into cracks in rocks, then freezes. Since water expands when it freezes, the cracks are enlarged and the rocks continue to break down.

Water isn't the only thing that causes erosion. Wind erosion is also a serious problem in many parts of the world, especially in arid or semiarid regions. Agriculture suffers from the effects of wind erosion. During the 1930s, the Great Plains of the United States were subject to disastrous dust storms because of a long dry spell. This period in American history caused great hardship for the people who lived in that area, called the Dust Bowl. Although the Dust Bowl was the worst case of wind erosion, much land in the Great Plains was damaged by wind erosion as recently as 1996.

When wind erosion occurs, the lighter, less dense soil near the surface is removed. This is the most fertile part of the soil, so the land is then less productive. Blowing soil can also damage small plants. The dust fills the air, causing poor visibility and pollution. In the United States, wind erosion affects the Great Plains more than any other region, but it is also a serious problem in sandy coastal areas and in cultivated soil everywhere. After the Dust Bowl crisis, experts in prairie agriculture began searching for ways to control and prevent wind erosion. A lot of progress has been made. There are three basic objectives when trying to prevent wind erosion. First, you need to reduce the wind velocity at the surface of the soil. This can be done by planting windbreaks, leaving crop residues in the fields, planting cover crops, and increasing the roughness of the surface. Trapping soil particles is also



*At its most extreme, stream or river erosion has created wonders like the Grand Canyon in the United States.*

important. Ridging or roughening the surface of the soil will trap soil particles so they can't blow away. The third objective is to increase the size of the soil aggregates, which means creating clods on the soil's surface. Then it will take a stronger wind to move the larger chunks of soil.

Maintaining plant cover for the soil helps accomplish these objectives. Bare fields are especially at risk for wind erosion. Farmers often leave stubble standing in the fields over the winter. This helps prevent wind erosion, reduces evaporation, and traps snow, which provides extra moisture for the soil in spring.

Erosion isn't all bad, though. Without it, we wouldn't have sandy beaches, as the sand is made up of particles eroded from the rocks and soil along the coast. All soil is also made from the weathering of rocks. Erosion by glaciers gave us many of the lakes we enjoy for recreation and fresh water. Glaciers scooped out depressions that filled with water, creating the Great Lakes and many smaller lakes.

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## escarpment

IN GEOLOGY, an escarpment is a steep edge of a ridge or cliff, characterized by an abrupt transition in altitude between two relatively level but differently composed series of sedimentary rocks, differing in age and composition. Escarpments, also known informally as “scarps,” are usually representative of the line of erosion of newer rock over the older rock and can exist both on dry land and below water. Escarpments are types of precipitous cliffs that can be formed by faulting of land or erosion by the elements of weather such as wind, water, or ice and are likely to be formed of limestone, sandstone, chalk, granite, and basalt.

Studies performed on various escarpment samples show that, in many cases, they were formed as a result of a process of erosion dating back over millions of years. Depending on circumstances, most escarpments have developed by erosion of ice dating back to the Ice Age or of water from the melting of glaciers and flows of streams. In some cases, more than one escarpment can exist in the same place. In other cases, escarpments are eroded and further formed from the sliding movement of sediment under water, such as with oceanic water movement and submarine landslides.

Escarpments on land can serve as homes to a wide variety of trees, plants, and other organisms that have been forced there or that simply prefer to live on rocky areas. Dense colonies of organisms, algae, and fungi, previously thought to be found only in distant ecotones such as Antarctica, have been found to exist in many dry land escarpments.

Escarpment formations have also been found on other planets, such as in the mountains of Jupiter’s moon, Io. Geologists think escarpments have been formed from a combination of unstable land and volcanic stress.

Little by little, escarpments and cliffs are undergoing changes and erosions of a different kind as an ever-increasing number of people discover the wonders of

the outdoors through rock climbing. Often, as the climbers scale along the rock surfaces, they pull out plants and brush in order to make the climbing surfaces safer and easier to navigate. The removal of the fauna and flora, as well as the steady rate of climbers passing through, is progressively changing the face of many escarpments and natural landscapes around the world.

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## esker

AN ESKER IS A LONG, narrow, often snakelike ridge of sand and gravel deposited on top of the ground where a glacier has retreated. Eskers often follow valleys and lowlands, although some can go uphill. Most eskers are a single ridge, but there are also braided ridges, which are similar in shape to river tributaries. The esker got its name from an Irish Gaelic word, *eiscir*, which means “ridge of gravel.” If they are viewed from the air, eskers stand out from the rest of the terrain. They often look like large railroad embankments. Eskers are made up of all sizes of fluvial materials, from fine grains of sand to boulders. Most material, though, is the size of gravel. The finer sediments are often found near the top of the esker, while the large boulders will be much deeper. Eskers usually have steep sides of 25–30 degrees.

Most eskers formed during the time when glaciers were melting and retreating. A tunnel formed in the ice within the glacier, and meltwater began to run through the tunnel like an underground river. The water carried sediment with it. As it slowed down in certain places, some of the sediment was dropped and began to fill up the tunnel. As the tunnel filled up, the pressure of the water eroded the ice above it to make room for the water to continue flowing. Therefore, the whole tunnel

seldom filled with sediment. When the glacier melted, the sediment in the tunnel was lowered to the ground. It followed the route of the underground river, which was usually perpendicular to the face of the glacier.

Most eskers formed in enclosed tunnels through which water flowed, but a few formed in ice-walled trenches that were open to the sky. Only in the channels that were closed by ceilings was the water able to flow uphill. This worked like water under pressure in the pipes of a water system. In the ice channels on top of the glacier, the sediment was let down to ground level as the glacier melted. Eskers range from a few meters high to over 250 ft (200 m) high. However, most are 100 ft (30 m) or less. Some are a few miles long, and others can be as long as 311 mi (500 km). Scientists believe that a very long esker probably did not form as one event but is made up of many individual eskers formed together during the retreat of the ice sheet.

Most eskers consist of a long, continuous ridge, but some have breaks in them. This happened because in some places, if the water was flowing more quickly, no sediment was deposited. Sediment was laid down when the speed of the water slowed down. Some eskers are known as “beaded eskers.” They have a regular pattern of narrowing and widening out. This is believed to have been due to the fact that more sediment was deposited in summer than in winter.

Through the years, eskers have served several purposes. Since they are raised above the surrounding terrain and are often more firm than the land around them, they have been used as road beds. In IRELAND, the Eiscir Riada is still used as the base of Highway N4/NM6 from Dublin to Galway. The land around it is boggy, so the esker provides a firm foundation for the road. In the wilderness, wildlife typically use eskers as travel routes. Eskers have also been used as graveyards and golf courses. Recently, prospectors have used eskers to predict where diamonds will occur. Bush pilots flying over the Canadian wilderness often use eskers to guide them. The largest eskers in the world are found in the Canadian provinces of Nunavut, Manitoba, Quebec, and Labrador.

Many eskers have entirely disappeared, though, because the gravel that made up the esker has been excavated and used to build roads. Where a gravel pit has been dug in an esker, scientists are able to study the internal structure of the esker.

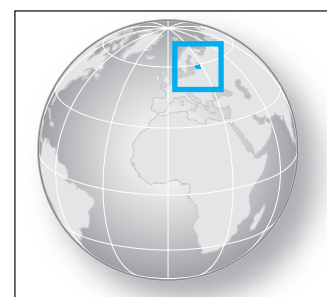
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## Estonia

**Map Page** 1130 **Area** 16,852 square mi (43,211 square km) **Population** 1,408,556 **Capital** Tallinn **Highest Point** 1,050 ft (318 m) **Lowest Point** 0 m **GDP per capita** \$10,900 **Primary Natural Resources** oil shale, peat, phosphorite, clay, limestone, dolomite.



FOR CENTURIES DOMINATED by its larger and stronger neighbors, since independence from the former Soviet Union in 1991, the small country of Estonia has shown itself to be the economic tiger of the former communist countries of Eastern Europe. The smallest of the three Baltic states, Estonia was the first to reintroduce its own currency and has managed to reduce inflation from 1,000 percent in 1992 to 2.8 percent in 1999 and unemployment to a mere 3.3 percent, well below the EUROPEAN UNION (EU) average. Having joined the NORTH ATLANTIC TREATY ORGANIZATION (NATO) in 2002, Estonians embarked on a new course, firmly directed toward the West, with membership in the EU dating from May 1, 2004.

Estonia is closely tied to the Baltic region, with a long coastline (2,618 mi or 3,794 km), including its northern coast on the Gulf of Finland and over 1,500 islands in the Baltic Sea. The largest of these are Saaremaa and Hiiumaa. Its neighbors include RUSSIA to the east, and LATVIA to the south, with FINLAND a short distance across the gulf (about 53 mi or 85 km) at its closest. Historically, the region was connected to other Baltic powers through sea commerce and the economic expansion of German merchants during the Middle Ages. Estonia's towns were essentially German for most of their history as members of the vast Hanseatic League, including its main city of Tallinn, formerly known as Reval. The area formed a province in the



changing empires of the region, either Danish, German or Swedish, and finally Russian from 1721. The Estonian people themselves, sharing ethnic and linguistic affinity with the Finns (and, more distantly, Hungarians), generally populated the countryside and served as the agricultural labor force supplying the industry and trade of the Germanic towns. In the 19th century, however, Estonian nationalism stirred and began to clamor for an independent Estonia for Estonians. Yet as late as 1914, the so-called Baltic Barons, German noble landowners, still owned 90 percent of the large agriculture estates (60 percent of the total land) and dominated the cities as they had done since the Middle Ages. With GERMANY's defeat in 1918, Estonia declared itself independent, but this was short-lived, and the country was occupied by the Soviet Union in 1940, and formally declared a Soviet socialist republic.

The terrain is mostly flat and marshy in the north and west, becoming more hilly in the south and east. Bogs and wooded swamps cover a fifth of the country, and there are over 1,500 lakes. The largest of these lakes form part of the border with Russia, Lake Peipus and Lake Pskov. These lakes are connected by a channel, and flow out toward the Gulf of Finland through the Narva River. Võrts-Järv is a large inland lake whose waters flow eastward into Lake Peipus, passing by Estonia's second-largest city, Tartu.

### ESTONIAN INDUSTRY

The Narva corridor is also the center of Estonia's heavy industry, highly developed under the Soviet regime, with more investment per capita from Moscow than any other part of the Soviet Union. Estonian industry was geared to production of oil—from one of the world's largest deposits of combustible shale—and also military supplies. Leningrad, roughly 245 mi (395 km) away, became dependent on Estonia for gas and oil, but also relied on Estonia's fertile soils and dairy farms for its food needs, much as the city had done (as St. Petersburg) since its founding in the early 18th century.

Estonians remain wary of the large Russian population still living in Narva, while it converts the remains of the Soviet military industry to more useful products. Estonia has a very low population density, allowing much of the land to remain cultivated in small farms or left wooded for the second-largest economic activity, timber, paper, and furniture. Approximately one-third of the population lives in Tallinn. The fastest growth is occurring in service industries, such as tourism, trade and banking, and Estonia is becoming famous as a leader in e-government.

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## Ethiopia

**Map Page** 1114 **Area** 435,184 square mi (1,127,127 square km) **Population** 66,557,553 **Capital** Addis Ababa **Highest Point** 15,158 ft (4,620 m) **Lowest Point** -410 ft (-25 m) **GDP per capita** \$700 **Primary Natural Resources** precious metals, natural gas.



ETHIOPIA IS LOCATED in northeastern Africa, an area rich in geography, climate, and history. The Great Rift Valley, which extends across most of east Africa, bisects Ethiopia's central mountainous plateau, providing the country with highlands, mountains, plains, and climatic diversity. The heaviest rains occur in the summer months with a lighter rainfall in the spring, when the monsoons arrive from the INDIAN OCEAN. Rains in the south and southwest of the country are nearly continuous over the year, moderating temperatures in the highlands, where most of the population lives, and leaving the eastern plains drier and hotter. The capital, Addis Ababa, is located at 8,000 ft (2,450 m), with average yearly temperatures of 68 degrees F (17 degrees C).

The nation's major river, the Blue Nile, is fed by runoff from the western portion of the plateau and flows toward the NILE and SUDAN to the west. Ethiopia's forests and wooded areas are concentrated in the southwest, and are centers of coffee production, while cattle are grazed on the grasslands. Despite its climate, Ethiopia faces severe deforestation and DESERTIFICATION problems, mainly caused by the civil war, drought, and famines.

Ethiopia is rich in human history. The earliest known hominid, "Lucy," was unearthed in 1974 near Addis Ababa and was dated to 3.5 million years ago. Archaeological research indicates continuous human habitation for the past 2 million years. Neolithic civi-



lization entered Ethiopia from EGYPT and the RED SEA, indicating a trading network that connected the area to the Mediterranean and Arabia. Traditional Ethiopian history started when the Queen of Sheba, purportedly from Ethiopia, visited King Solomon in the 10th century B.C.E. Historically, however, Ethiopian history originated in the second millennium B.C.E. under the influence of the Egyptians and later Greeks. An independent Ethiopian civilization emerged in the 1st century C.E. in Aksum and its seaport, Adulis. The Aksumite kingdom traded with the peoples of the Red Sea and interior of Africa.

In the 4th century C.E., Greek missionaries introduced Christianity from Alexandria, EGYPT. In 451, exiled Greek and Syrian monks established Monophysite Christian communities throughout the kingdom furthering the influence of the Egyptian Coptic rather than the Roman Catholic Church. In 525, the Aksumite king, responding to a request from Emperor Justinian I to aid persecuted Yemeni Christians, invaded and occupied the southern portion of the Arabian Peninsula until the Aksumites were expelled by the Muslims at the end of the century. The Aksumites, however, used their expanded holdings to trade with INDIA and maintain communication with the Byzantines.

This period of expansion was not long lasting because by the middle of the 7th century, Islamic invaders from Arabia conquered Egypt, isolating the Auxites from the broader Christian world. Isolation meant a gradual political decline over the next 300 years, with central authority collapsing in the 10th century. Ethiopia entered a period of warring chieftains and provincialism. Finally, in the late 13th century, the Solomonic dynasty, so named after its lineage to King Solomon and the Queen of Sheba, reestablished central authority with the new dynasts claiming the title of Negus Negusti, king-of-kings. The kingdom consolidated political and military power and expanded against a series of smaller Muslim principalities to the south. During this period of renewed expansion, Europeans reestablished contact with the Christian Ethiopians.

In 1490, Portuguese explorers searching for the legendary Christian kingdom of Prestor John arrived and subsequently aided the Ethiopians against the Muslims. Relations with the Europeans soured when the Portuguese tried to pressure the Ethiopians into accepting Roman Catholicism. The Ethiopians then expelled the Europeans and enacted a strict isolationist policy, which lasted until European imperialism encroached into Africa during the 19th century.

In 1869, Italian imperialists purchased the nearby Red Sea port of Assab from the Egyptians. In 1882, Italy acquired the surrounding territory and merged their holdings into a single colony. Not satisfied, the Italians expanded northward along the coast into territory claimed by the Ethiopian kingdom. To avoid potential conflict, the Italians and Ethiopians agreed in 1889 that Italy could expand into limited areas of northern Ethiopia. Tensions mounted, however, after Italy formed the colony of ERITREA and became involved in a dynastic struggle in Ethiopia. The tensions touched off a native uprising in Eritrea, leading the Italians to invade Ethiopia hoping to end any aid given the native Eritreans by Ethiopia.

The Ethiopians soundly defeated the invaders in 1896 at the Battle of Adowa, thereby ensuring the empire's continued independence from European imperialism until well into the 20th century. The Italians vowed revenge, and in 1935 the Italian fascist regime invaded and conquered Ethiopia. Emperor Haile Selassie fled to Great Britain and remained in exile until the Allies liberated Ethiopia and Eritrea in 1941. Selassie returned to power and in 1952 ruled over a federal system of Ethiopia and Eritrea until the early 1960s, when he annexed Eritrea.

In 1974, the Derg, a military council, overthrew the emperor and eventually imposed a totalitarian regime with Soviet aid. In 1991, the rebel Ethiopian People's Revolutionary Democrat Front, a coalition of the various domestic opposition groups, overthrew the government and promulgated a new constitution. Under pressure from ethnic minorities for more local government, the new government subdivided the nation into nine provinces with a legislative assembly.

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## Ethiopian Highlands

ETHIOPIA IS A LANDLOCKED nation located in northeastern Africa in an area known as the HORN OF

AFRICA. While containing large stretches of plains in the east and south, the country is dominated by highlands, which rise to well over 3,000 ft (1,300 m), and the Great Rift Valley, which is several hundred meters below sea level. Elevated plateaus compose much of the geography in northeastern Africa, an area close to the RED SEA, which encompasses both ERITREA and ETHIOPIA. Likewise, the Great Rift, formed 50 million years ago by volcanic activity, also extends across most of eastern Africa and bisects Ethiopia's central mountainous plateau from roughly the southwest to the northeast, creating two highland areas. The largest, the western side, is known as the Ethiopian Plateau and is the higher of the two, with the tallest peak, Ras Dashan at 15,158 ft (4,620 m). Located in the Simen Mountains, the peak is located southwest to two similar, though slightly less imposing mountains. Aside from being among Africa's highest mountains, the area is also the source of the Blue Nile, Lake Tana.

Land on the eastern plateau slopes in a generally westerly direction and provides much of Sudan, and ultimately the NILE, with water. The smaller, eastern plateau extends toward the Gulf of Aden, on the INDIAN OCEAN, and divides the lowlands to the east, near Somaliland, from the Danakil Desert by the Eritrean border. The verticals of both plateaus are very impressive.

In the center, the Great Rift rises at almost a vertical to both heights. The eastern spur, however, is generally more gradual than the Ethiopian plateau in the west and slopes into the surrounding desert. Water erosion has created impressive cuts throughout the highland; vertical drops of many thousands of feet are common. In addition, the same erosion has created smaller plateaus, known as *ambas*, which are the sites of many of the nation's important battles and monasteries.

The highlands obviously have influenced Ethiopia's climate, demographics, and history. Despite being so close to the equator, Ethiopia has a quite moderate climate largely because of its heights. Outside of the Danakil depression, the Great Rift Valley floor, and the eastern plains, which are primarily desert, Ethiopia's climate varies from alpine, in the higher mountains, to moderate. The capital city, Addis Ababa is located at 8,000 ft (2,450 m), with average yearly temperatures of 68 degrees F (20 degrees C).

Winter, which can be very brutal in some higher areas, lasts from October to February. Spring is generally drier, though some rains do occur. The heaviest rains fall in the summer months, from June to mid-Sep-

tember, and taper off in the autumn months. Given the relative heights and sloping of the highlands, and the amount of water it receives, there are numerous lakes and rivers. Most of the forests are in the southwest, while the plateau highlands contain scattered copses and GRASSLANDS. Fauna in the highlands are mainly domestic animals, such as cattle, which graze on the grasslands, and birds, large cats, hyenas, and wolves.

Early human habitation started out in the Rift Valley, with the oldest human ancestor being found there in 1974. Over time, habitation expanded to the highlands, providing people with rich soil and grazing space for their animals. One of the first Ethiopian civilizations arose in the northwest plateau, at Aksum. Over time, the highlands, including portions of northern and northwestern Eritrea, were incorporated into various Ethiopian Christian kingdoms, often at war with the Muslims in the eastern lowlands. The highlands protected Ethiopia from many foreign invasions, particularly from the Italian colony of Eritrea in 1896. At the Battle of Adowa, fought in the highlands just south of the Eritrean border, the Imperial Army of Ethiopia destroyed an Italian-led Eritrea force. The highlands, however, were unable to completely protect against the Italian invasion of 1935.

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## European Union

THE EUROPEAN UNION (EU), with 25 member states in 2004, had its initial organization created after World War II for the purpose of rebuilding Europe after the turmoil and devastation of the war. It was thought that economic and political cooperation would greatly reduce the risks of repeating such a conflict and would be the first step toward unifying European interests.

The idea was to create an internal market in order to enhance economic growth. Created as a predecessor organization in 1951 with six countries, what became the European Union has added countries to the consortium four times, and in 2004 was preparing for its fifth expansion. The EU benefits consumers (lower prices,

greater choice of goods and services, work conditions within the EU) and businesses (fair competition, economies of scale, expansion to global markets).

The European Union comprises countries in the continent of Europe, bordered on the west, north, and south by the ATLANTIC, ARCTIC, and MEDITERRANEAN oceans and seas. The eastern border of the continent, however, is to some extent vague. Some people believe that the URAL MOUNTAINS of RUSSIA, the Ural River and the CASPIAN SEA are the eastern border of Europe. Others believe that the border with Russia is Europe's eastern boundary, while some others separate Europe from Asia by the Bosphorus Strait.

As a continent, Europe is relatively small. Its physical landscapes, however, are varied and complex. The countries in Europe differ in climate, vegetation, and elevations: From the warm and dry Mediterranean climates in southern Europe, to the frigid climates of northern Scandinavia; from the moist woodlands of Western Europe, to the dry STEPPES in the eastern extremities of Europe; and from the flat coastlines of the NORTH SEA, to the majestic ALPS.

The formation of the European Union began with six countries: BELGIUM, GERMANY, FRANCE, ITALY, LUXEMBOURG, and the NETHERLANDS. After nearly 50 years, four different expansions included: 1973: DENMARK, IRELAND, and the UNITED KINGDOM; 1981: GREECE; 1986: SPAIN and PORTUGAL; 1995: AUSTRIA, FINLAND, and SWEDEN; 2004: CYPRUS, CZECH REPUBLIC, ESTONIA, HUNGARY, LATVIA, LITHUANIA, MALTA, POLAND, SLOVENIA, and SLOVAKIA. The next expansion is scheduled to occur in 2007, with BULGARIA and ROMANIA joining the EU. The countries of CROATIA and TURKEY have also applied for membership but have not been accepted for the 2007 expansion.

Other milestones of the enlargement of the European Union include the following:

1952: The European Coal and Steel Community (ECSC) was founded by Germany, France, Italy, the Netherlands, Luxembourg, and Belgium.

1958: The European Economic Community (EEC) and Euratom were founded. The EEC was a community in which free trade for all products was established. Euratom dealt with research, production, and safety in the nuclear energy sector.

1967: The three organizations (ECSC, EEG, and Euratom) were merged into the European Community (EC).

1991: Maastricht Treaty (the Treaty of the EU) goes beyond the internal market program and includes additional areas in the integration process.

1993: The EC was renamed European Union.

1997: The Amsterdam Treaty was signed.

The total geographic area of the EU is 2,419,064 square mi (6,265,347 square km), and if it were a country, it would be the seventh-largest in the world by geographic area. The number of EU citizens (all member state citizens or subjects, under the terms of the Maastricht Treaty) is about 453 million (March 2004). The population of the EU, considered as one country, would be the third-largest in the world after INDIA and CHINA. Germany has the largest population, with 82.5 million inhabitants and Malta is the smallest, with 387,000 people. Many countries, such as MONACO and ANDORRA, while not being member states, have special agreements with the EU. Other areas have connections or associations with EU member states through a colonial past, cultural links, or geographic placement: GREENLAND, the Isle of Man and the CANARY ISLANDS.

The addition of countries to the EU raises issues about how the member countries are affected. Specifically, economists consider the implications for southern European countries (Spain, Italy, Portugal, and Greece) which are major beneficiaries of EU's redistribution programs. The enlargement of the EU not only effects change in economic geography, it creates change in the political landscape (national sovereignty and political governance) and cultural geography.

## LARGEST ECONOMY

In 2004, the EU had the largest economy in the world. The EU continues to have an import surplus, contrasting the widening trade deficit that affects the United States. However, in 2004 the EU had stagnant economic growth with low employment. It is anticipated that the gross domestic product per capita of the whole EU will fall over the short-term. In the long-term, the EU's economy will suffer from significant demographic challenges.

The EU has no designated capital city, but Brussels is the de facto administrative center, as it is the home of the European Commission, the Council of Ministers and the European parliamentary commissions. The European Parliament sits in the French city of Strasbourg while Luxembourg is the seat of the European Court of Justice and parliamentary offices.

As the changing name of the EU (from European Economic Community to European Community to European Union) suggests, the EU has evolved over time from a primarily economic union to an increasingly political one. This trend is highlighted by the increasing number of policy areas that fall within the EU areas of

interest. Political power has tended to shift from the member states to the EU.

This picture of increasing political focus can be illustrated by two points. First, some member states have a domestic tradition of strong regional government. This has led to an increased focus on regional policy in the European regions. A Committee of the Regions was established as part of the Treaty of Maastricht. It led to the formal creation of the EU and was the result of separate negotiations on the Monetary Union and on the Political Union.

### THE EURO

The Treaty of Maastricht led to the creation of the euro (the European currency) and introduced a three-pillar structure (the Community pillar, the Common Foreign and Security Policy, or CFSP, pillar, and the Justice and Home Affairs pillar). There was a desire to focus the EU on the areas of foreign policy, security and defense policy, asylum and immigration policy, police cooperation, and judicial cooperation. Within each pillar, a different balance is struck between the supranational and intergovernmental principles.

Originally, the European Community was essentially concerned with economic and trade matters. The European Commission and the European Court of Justice were both independent from the EC governments and had a lot of power within the system. The European Parliament, which was directly elected by the citizens of the EC member states, also had some limited power.

Additionally, EU policy areas covers a number of different forms of cooperation: 1) autonomous decision making; 2) member states laws are harmonized through the EU legislative process, which has resulted in EU laws becoming increasingly present in the systems of the member states; and 3) member states agree to coordinate their domestic policies.

The tension between EU and national (or sub-national states) is an enduring one in the development of the organization. All prospective members must adopt, implement, and enforce legislation in order to bring themselves into line with the common European legal framework. The entire body of European laws is known as the “Acquis Communautaire.” This includes all the treaties, regulations, and directives passed by the European institutions as well as judgments issued by the Court of Justice. The EU is characterized by sharing a broad number of issues and covering specific issues in the internal market and its external relations. With respect to the single market internal aspects, the

main principles are the free movement of goods, services, persons and capital (a goal further extended to some countries by the European Economic Area, EEA); a common EU competition policy controlling anti-competitive activities of enterprises (antitrust, abuse of dominant market position, merger controls) and member states; and freedom for citizens of its member states to move, live, and work anywhere within the territory of the member states, provided they can support themselves (also extended to other EEA states).

The last has resulted in the elimination of checks on individuals at the borders between EU member states. The Schengen Treaty authorized the elimination of internal border controls and coordination of external controls between its member states. This excludes the United Kingdom and Ireland, which have continued to check all persons entering their borders. In addition, two non-EU countries—ICELAND and NORWAY—participate through special agreements.

The EU seeks policy coordination in a changing regulatory environment. This effects government regulation, corporate law, and trademark registrations by lowering administrative costs, stimulating cross-border business cooperation, and creating greater attractiveness for outside investors. The single currency, the euro, has been adopted by all member states except the United Kingdom, Denmark, Sweden, and the last 10 countries that entered the EU in 2004. The adoption of a single currency is the final part of the Economic and Monetary Union (EMU). The first stage was to remove barriers to free-up the movement of capital, and the second stage was to set up the European Central Bank. Stage three consisted in the introduction of the euro currency and its adoption by most part of member states at the start of 2002.

The EU promotes common agricultural policies (CAPs). The CAP was established in the late 1950s as a response of food shortages in Europe. Today, CAP addresses other problems (overproduction, sustainability of agriculture and food). CAP expenditure accounts for approximately 45 percent of the EU budget.

The EU also establishes a common system of indirect taxation, the VAT (value added tax), as well as common customs duties and excises on various products. It provides resources for the development of disadvantaged regions (structural and cohesion funds). With regard to the external issues to the internal market, the EU forms a customs union with a common commercial policy vis-à-vis countries outside the EU. This policy is pursued within the World Trade Organization regulations. Further, the EU provides resources





*The enlargement of the European Union not only effects change in economic geography, it creates change in the political landscape (national sovereignty and political governance) and cultural geography.*

for programs in candidate countries and other Eastern European nations, as well as aid to several developing nations.

For the future, the EU is considering the possibilities of EU citizens voting on local government and European Parliament suffrages in any member state;

collaboration in criminal issues, comprising intelligence issues through the European Police Office (Europol) and the Schengen Treaty; a unique foreign policy for all EU member states; and a common security policy, including the creation of 60,000-member European Rapid Reaction Force (ERRF) for peace-keeping and conflict prevention purposes.

The EU is in many ways a unique phenomenon. The EU institutions do not exclusively reflect the characteristics of supranational institutions, but rather a combination of both intergovernmentalism and supranationalism. An essential tension exists within the EU between intergovernmentalism and supranationalism. The final goal of intergovernmentalism is the protection of sovereignty (power is possessed by member states and decisions are made by unanimity). An alternative method of decision making in international organizations is supranationalism. This denotes a framework in which supranational factors possess a significant impact on the member states (member states still have power, but they must share this power with the other member states).

This institutional challenge is probably the greatest of all challenges facing the EU. Intergovernmentalism has historically been preferred by France, and by more Euro-skeptic countries such as the United Kingdom and Denmark, while more integrationist nations such as Belgium, Germany, and Italy have tended to favor the supranational framework.

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## Everest, Mount

A PEAK ON THE CREST of the Great Himalayan range in Asia, Everest is the highest point on the Earth. It lies in the Central HIMALAYAS on the border between NEPAL and CHINA (Tibet). Three barren ridges, the south-

east, northeast and west culminate in two summits at Everest (29,028 ft or 8,848 m) and South Peak (28,700 ft or 8,748 m). The mountain can be seen directly from its northeastern side where it rises about 12,000 ft (3600 m) above the plateau of Tibet. It claims an incredible view from the top. The formerly accepted elevation of 29,028 ft (8,848 m) established in the early 1950s was recalculated in the late 1990s as 29,035 ft (8,850 m). Its identity as the highest point on the Earth's surface was not recognized until 1852, when the Survey of India, a government organization established that fact. In 1865, the mountain, previously referred to as Mountain Monarch or Peak XV, was renamed for Sir George Everest, a Welshman, who was the surveyor general of India from 1830 to 1843.

The summit itself consists of rock-hard snow; surrounded by a layer of snow that fluctuates annually by some 5 to 7 ft (1.5 to 2 m). It is highest in September and lowest in May, after depletion by the strong northwesterly winter winds. Though the exact thickness of snow atop Mount Everest remains a mystery for scientists around the world, the measure taken by an Italian mountaineering team was more than 8 ft (2.5 m). Individual glaciers around Mount Everest are the Kangshung Glacier (east), Rongbuk (north and northwest), the Pumori (northwest), the Khumbu (west and south) and an enclosed valley of ice between Everest and the Lhotse-Nuptse ridge. The mountain's drainage pattern radiates to the south, west, north, and east. The glaciers melt into rivers flowing towards Tibet and Nepal. Precipitation falls as snow during the summer monsoons (May to September). Lack of oxygen, powerful winds, and extremely cold temperatures preclude the development of any plant or animal life on the upper slopes. At the summit of Mt. Everest, atmospheric pressure is only 30 percent that of sea level, so the climbers take in only 30 percent as much oxygen (and thus need to carry oxygen tanks). There are no permanent settlements here because no one can adjust year-round to such high altitudes.

Attempts to climb Everest began with the opening of the Tibetan route in 1920. Everest was finally surmounted in 1953 as a result of efforts by an expedition sponsored by the Royal Geographical Society and the joint Himalayan Committee of the Alpine Club. On May 29, 1953, Edmund Hillary and Tenzing Norgay became the first to reach the top of the world's highest peak. Since then, 1,200 men and women from 63 nations have reached the summit. Nearly 200 others have perished in the attempt. Japanese woman climber Junko Tabei in 1975 became the first woman to sum-

mit Everest. The South Col route to Everest is the most popular and used by more climbers than any other path. The north ridge route begins in Tibet. At the foot of Mount Everest, Rongpu Gumpa is the highest monastery in the world. The local people revere the mountain. Its Nepali name (Sagar matha) and Tibetan name (Qomolangma) mean “Goddess mother of the world.” The Sherpas, an ethnic group of the Khumbu valley beneath Everest, urge their clients to ask the mountain deity’s blessings with offerings of rice and incense at base camp. Buddhist legend holds that Everest is home to a goddess bearing a bowl of food and a mongoose spitting jewels. Everest has indeed brought prosperity to the region.

The first ascent of Mount Everest sparked a tourism boom that draws more than 20,000 visitors each year to hike amidst the planet’s tallest peak. The 50th anniversary of the first ascent of Everest was celebrated in May 2003. Efforts at cleaning up the Everest slopes started in 1994, and more than 20,000 pounds of garbage have been hauled off the peak. Sherpas are paid to bring down used oxygen bottles and other trash.

A Chinese survey has revealed that the world’s highest peak is gradually losing its height because of global warming and the shrinking of glaciers in the Himalayan region. According to a scientific survey report released at a recent international symposium held in Lhasa, Tibet, the mountaintop declined by 4.2 ft (1.3 m) in the 33 years ending in 1999. Global warming accelerates the process of conversion from snow to ice.

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*Everest's formerly accepted elevation of 29,028 ft (8,848 m) was recalculated in the late 1990s as 29,035 ft (8,850 m).*

whenever we use the wheel, look at the clock or our watches to tell time divided into units of 60, or view our calendars as a revision of the method the ancient Egyptians used in dividing the year. Our inheritance in both experience and knowledge from the past is far more than we know or realize.

No one knows exactly when humans began the transition from hunting and gathering to sedentary living. But we do find a very close relationship between the organization of humans in settled areas and the rise of agriculture and the domestication of crops. Agriculture had its most referenced beginnings at least 7,000 years ago in two great centers: one in the fertile alluvial plains of a land called Mesopotamia and the other along the lower reaches of the Valley of the Nile. We shall leave the interesting question of the precise area in which agriculture originated to the archaeologists. It is enough for us to know that it was in these alluvial plains in an arid climate that the first tillers of soil began to grow food crops using IRRIGATION in quantities that exceeded their own needs.

Where agriculture was practiced under especially favorable conditions, it was even possible to produce more food than the local inhabitants actually needed at any given time. The significance of being able to produce surplus food can scarcely be overemphasized, for by releasing some workers from the day-to-day chores of tilling the fields, it permitted a diversification and

## exotic rivers

THERE IS A WRITTEN record on the land in the Near East. Here, civilization arose out of the mysteries of the stone age and gave rise to cultures that moved eastward to CHINA and westward through Europe and across the ATLANTIC OCEAN to the Americas. Achievements of ancient origin serve as constant reminders of our debt to the Sumerian peoples of Mesopotamia

specialization of labor that had never before been possible.

Of course, the basic need behind all of this is water, for without water there is little evidence of life let alone society or civilization. Even today, we find more than 90 percent of the world's population living within 62 mi (100 km) of the coast or a major navigable river. It should also be pointed out that in the wake of surplus food production and the concomitant necessity for food storage, other modifications in the material culture of the peoples were almost inevitable hallmarks of such an advance. Vessels for storage, such as baskets and pottery, now became part of the inventory of the average household. And the latter, in particular because of its relative imperishability, has become a favored diagnostic tool of the archaeologist in tracing the economic evolution of a culture.

Although examples of preagricultural ceramics do exist, the more usual case is that they are evidence of a settled, farming society of greater complexity and sophistication. It was this organization of community (or place) around a multitude of functions that led Greek scholars to later conclude that cities grew up as a response to human NEEDS AND WANTS.

## RIVER CIVILIZATIONS

Historically, the archaeological evidence suggests that the first great civilizations were all river civilizations. Even more interesting is the fact that in each of these early cases, the lands on which these early civilizations took form were also very dry, DESERT or semidesert environments. Desert regions can be found on all continents and they occur in two zones, one on either side of the equator. One zone is found between 15 degrees N and 30 degrees N latitude and the other between 15 degrees S and 30 degrees S latitude. Most deserts are found on the western side of continents and extend inland. Only the Sahara Desert extends from one side of a continent to the other.

Though little rain falls in deserts, deserts receive runoff from ephemeral, or short-lived, streams fed by rain and snow from adjacent highlands. These streams fill the channel with a slurry of mud and commonly transport considerable quantities of sediment for a day or two. Although most deserts are in basins with closed, or interior, drainage, rivers that derive their water from outside the desert cross a few deserts.

These rivers receive a lot of rainfall (or snowfall) in the areas where they arise, that is, in the area known as their headwaters. This large supply of water allows them to flow across the desert even though a lot of

water is lost through evaporation into the atmosphere or through seepage beneath the desert surface. These rivers are called exotic rivers because the water they carry comes from outside the desert region they pass through. Such rivers infiltrate soils and evaporate large amounts of water on their journeys through the deserts, but their volumes are such that they maintain their continuity.

These older, specially favored areas of human habitation and food production have typically been found in the so-called exotic river valleys of the Near East, such as the Tigris and Euphrates in Mesopotamia (present day IRAQ), as early as 4500 B.C.E.; in the Nile Valley of EGYPT by 4000 B.C.E.; the Indus Valley of PAKISTAN by 3500 B.C.E.; the valleys of the AMU DARYA and Syr Darya in Central Asia by 3000 B.C.E.; and the HUANG (Yellow) and Wei river valleys of North CHINA by 2500 B.C.E. In every instance there was a desert climate with cloudless skies, lots of daily sunshine, little if any frost, little or no vegetation cover to clear, and rich alluvial soils coincided with a continuous supply of water from the adjacent river. Indeed, each of these exotic river valleys was either the cradle of a civilization in its own right or, at least, the beneficiary of a diffusion, which first began in Mesopotamia and was later emulated elsewhere under remarkably similar environmental conditions.

These so-called exotic rivers cross all of the large deserts of the world, except those of AUSTRALIA. Also, desert soils are usually quite productive when supplied with water. The most widely cultivated areas are where there are water-transported soils in the form of FLOODPLAINS and ALLUVIAL FANS.

There is good evidence that in the New World the model of "hydraulic" civilizations based on exotic rivers as described above may have been first replicated in the Atacama Desert along the west coast of PERU where about 40 short exotic rivers cut their way from the ANDES to the PACIFIC OCEAN. The other New World area where a hydraulic culture occurred was in the Colorado Plateau region of the southwestern part of the UNITED STATES (the southwest Anasazi culture), where the Colorado River cuts its way from the ROCKY MOUNTAINS across the plateau and into the Sonoran and the Mojave Desert before emptying into the Gulf of California. There are a number of examples of exotic rivers where civilization did not seem to take hold. These include the Snake River in IDAHO and parts of the Columbia River which cuts through desert landscapes of WASHINGTON and OREGON. There are no exotic rivers in Europe or Australia.



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## facilities mapping

FACILITIES MAPPING (FM) is the process of digitally identifying and mapping facilities infrastructure with the explicit goal to improve operational management and planning tasks such as dispatching, inventorying, and maintenance. Some examples of facilities include utilities (gas, water, telephone, and electricity), airport siting, and transportation planning. In the past, when a facilities map was needed, a team of surveyors and draftspersons would combine skills to develop such a map. Usually the map was created and updated manually. Today, in the competitive business world of facilities service provision companies must continuously find new ways to maintain and deliver efficient services. This is a challenge as the facilities infrastructure is usually dense and covers large geographic areas. Moreover, time is also a key component. The steps for a successful operational strategy is based on collecting and integrating information on organization assets, processes, potential and existing customers, and changing market situations.

The core of the FM system is built around computer-aided drafting and design (CADD), geographical information systems (GIS), and global positioning systems (GPS) technologies. This combination of geospatial technologies has also caused some confusion in drawing disciplinary boundaries of FM. Hence, terms

such as AM/FM (automated mapping/facilities management) and network management systems are essentially the same technology. Because of the linear characteristics of the utilities infrastructure, CADD software is generally the choice for digital encoding. But there is the tendency now to merge CADD systems with the spatial data management capabilities of GIS in order to develop more integrated databases.

The encoded facilities infrastructures are then linked to a database that holds detailed attribute information about each facility. By querying the map on the computer screen, information about each facility and its relationship to other facilities can be obtained for operational planning and management purposes. Updates can be quickly made using a digitizing table, a mouse, and a keyboard. Usually the decisions made using FM are not for analytical purposes but for allocating resources for service dispatching, inventorying, and maintenance. Nevertheless, analytical studies such as network analysis and catchments area analysis are possible with FM systems.

Global positioning systems also play a major role in facilities management. The GPS is a network of 24 orbiting satellites and Earth receiving stations that provide an accurate and unique coordinate position for any point on the Earth's surface. The network was originally designed as a navigational tool for military applications, but the civilian and research community

has quickly realized the value of the technology and adopted it for use in many navigational applications. The satellites transmit signals that anyone can collect with a suitable GPS receiver. For example, with inexpensive GPS receivers, utility service crews can be quickly dispatched to the location of utilities needing repair.

### INTEGRATED TECHNOLOGY

FM has benefited tremendously from integrating CADD, GIS, and GPS technologies, the key benefit being to provide an integrated solution to business operational planning and management. The mapping capabilities of the FM system store information in different layers providing multiple ways of generating focused maps from a single and consistent database. Usually maps of multiple scales are available to address the task. For servicing, detailed maps showing the accurate location of facilities in need of repair are essential. For planning, coarse scale maps may be sufficient as only overall distribution of the facilities infrastructure may be of interest.

A centralized database of information streamlines data control, access, and updating, thereby creating an overall efficient search and query operation. Because the utility maps are digital, sharing of data and information among different agencies operating in the same area becomes a distinct possibility. The sharing of data reduces duplication of efforts, minimizes unnecessary damage to adjacent facilities, lowers maintenance costs, and improves customer service.

Facilities mapping is still evolving as new beneficial technologies continue to emerge and become integrated in the FM core system. Internet mapping is one technology that has begun to impact FM systems development. The internet provides a distributed medium to connect parts of the same company at one location or different locations. Wireless and mobile computing are already impacting FM in many ways. Field teams can receive customer calls directly and, with the aid of wireless and mobile computing devices, report to a service-outage location in real time.

Knowing about the availability of existing service resources in the area or planning repair strategies before arriving at the location are distinct advantages of mobile and wireless computing. As companies move away from rigid vertical management structures, distributed technologies will play an important role in maintaining customer satisfaction and the competitive edge necessary for survival in an ever-changing business climate.

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## Falkland Islands

THE FALKLAND ISLANDS, a British dependency contested by ARGENTINA, which calls them the *Islas Malvinas*, are located in the South ATLANTIC OCEAN near South America, approximately 300 mi (483 km) east of Argentina. The Falkland Islands consist of two main islands (East and West Falklands), which are divided by the Falkland Sound. There are more than 100 smaller islands that are part of the Falklands. The island of South Georgia, which is southeast of the Falklands, is a territory of the Falkland Islands. The islands have a population of 2,379, with most living near the capital, Stanley. Occupying 4,700 square mi (12,173 square km), the territory's highest point is Mt. Usborne at 2,312 ft or 705 m.

The Falkland Islands were discovered by the British in 1592 but not claimed by the British until 1690, when a detachment landed for the first time and named it after the first lord of the Admiralty of the time. In the 18th century, French settlers stayed for a short period, and SPAIN also claimed sovereignty. The emerging Argentine state called for the succession of the Spanish, but the British took over the islands in 1833. British settlers since then stayed continuously, although the sheep production made it an economically difficult enterprise in problematic weather conditions (not too far from ANTARCTICA).

The strategic importance of the Falkland Islands is due to their proximity to the southern parts of South America and Antarctica. The islands came twice to global awareness, both in the setting of armed conflict. In 1914, the British navy smashed the East Asian Squadron of the German navy in the Battles of Coronel and the Falklands. In 1982, the Argentine military government occupied the islands but was defeated by the British when Prime Minister Margaret Thatcher de-



cided to resist this military assault. The inhabitants of the Falklands are nearly all of British descent and they never embraced Argentine rule. The British campaign in the Falklands was formidable and outstanding in all its major elements (navy, air force and ground force), as the British won under arctic conditions on islands literally “on the other side of the earth” (from Britain), whereas the Argentine mainland was in close proximity to the battleground. The British victory in the Falklands War led to an overthrow of the military dictatorship because of popular unrest within Argentina, whereby this was a first step for reestablishing democratic regimes in the whole of South America.

Before 1982, the British government was probably not really interested in keeping the economically deficient islands, but this changed dramatically when the Argentines took it by force. The economy of the Falkland Islands was changed forever after the liberation from Argentine occupation, as the now necessary military presence of British troops needed heavy investment (especially a large airport). Traditionally a coaling and whaling harbor, the Falkland Islands undertook an economic development program for exploiting oil fields within the territorial waters of the islands and for expanding tourism. The role of the Falkland Islands and of South Georgia as a springboard for missions in Antarctica should not be underestimated.

The relations with Argentina are still tense, as the Falkland Islanders suspect a new Argentine attempt to take over the islands. Although the British government is unambiguous about not changing the sovereignty of the islands against the will of the inhabitants, the defense of the islands since the 1982 war has cost an enormous amount of British taxpayers' money.

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## Faroe Islands

THE FAROE OR FAEROE Islands (Faerøerne in Danish, Farøyar in Faroese, meaning the “Sheep Islands”)

are located at the intersection of the North ATLANTIC OCEAN and the Norwegian Sea, roughly equidistant between NORWAY, SCOTLAND, and ICELAND. Their closest neighbors are the Shetland Islands, 190 mi (305 km) to the southeast. Like the Shetlands, the Faroes were first encountered and settled in the 9th century by Norwegian Vikings, but while the Shetlands were eventually given to Scotland, the Faroes remained part of the Kingdom of Norway, until 1814, when Norway was ceded by DENMARK to SWEDEN. The Faroe Islands (along with ICELAND and GREENLAND) remained a possession of the Danish crown and were given powers of self-government in 1948.

The group consists of 17 inhabited islands, including the main island of Streymoy (or Strømø in Danish) and one uninhabited island and islets. The other main islands are Eysturoy, Sandoy, Suderoy and Vágar. Altogether the coastline stretches 694 mi (1,117 km). The terrain is very rugged, with rocky peaks, and cliffs along most of the coast. Human habitation is thus limited mostly to narrow coastal lowlands. Although the islands are located very far north, the climate is surprisingly mild in the winters from the effects of the upper reaches of the GULF STREAM. Horses and sheep, for example, can winter in the open air. Summers are cool, and year-round skies are usually overcast, with an abundance of fog and wind.

The soil is generally very thin, but some crops can grow, including modest amounts of barley, turnips, and potatoes. There are little to no trees, but abundant turf, which is used for fuel. By far, the biggest industry is fishing and fish processing, with subsidiary industrial activity in shipbuilding and construction. Sheep rearing and dairying supplement the island economy, along with traditional handicrafts and coarse woolen goods. The newest enterprise for the 21st century is the vigorous exploration for potential oil reserves in the seas around the islands. The Faeroe Islands decided not to enter the European Union with Denmark in 1974 and have resisted most development of tourism and potential oil resources. A referendum for independence from Denmark failed in 2001.

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## Fayum

FAYUM (also spelled “Faiyum” or “Fayyum”), comes from the Coptic *Phiom* (“sea”), and geographically designates a *muhafazah* (governorate), formerly a *mudiria* (province) of Upper EGYPT, an oasis in north-central Egypt adjacent to the NILE RIVER, with significant paleontological and archaeological interest. Fayum is one of 26 administrative divisions of the Arab Republic of Egypt and is located in a great depression of the Western (Lybian) Desert south-southwest of Cairo. The *muhafazah* has an area of 707 square mi (1,827 square km) and a population of 1,550,000.

Its capital, located in the southeastern quadrant, also called Fayum, was formerly Madinat-el-Fayum (Medina or City of the Fayyum). The settlement dates to the 12th dynasty (1938–1756 B.C.E.) and achieved considerable importance during the Middle Kingdom. The city was called Shedet in pharaonic times, Crocodilopolis in the Ptolemaic era, and Arsinoe during the Roman period; there were substantial Hellenistic, Roman, Coptic, and Mamluk occupations, and it was a major Coptic Christian center until the Arabs arrived in 640 C.E. The capital is a major Sunni Muslim center with a population of 230,000.

Fayum Oasis, situated 149 ft (45 m) below sea level, is 15 mi (25 km) west of the Nile and separated from the river by a gravel ridge bordered on the west by the Western (or Libyan) Desert. It extends about 50 mi (80 km) east-west and 35 mi (56 km) north-south and is connected with the Nile by the Bahr Yusuf, a canalized river. Irrigation canals were originally dug about 1800 B.C.E.

Paleontologist Elwyn Simons and colleagues conducted research on early anthropoids and other vertebrate fossils from the only continuous sequence of fossiliferous continental middle- to late-Eocene and early-Oligocene deposits on the Afro-Arabian landmass. Important fossils include the genera *Propliopithecus*, *Aegyptopithecus*, *Parapithecus*, *Apidium*, *Oligopithecus*, *Catopithecus*, *Proteopithecus*, *Serapia*, *Qatrania*, and *Arsinoea*.

Human presence dates to the Paleolithic and Neolithic eras; Fayum A is the oldest Neolithic culture in Egypt. Pyramids were constructed on the ridge funerary complex, built by Amenhotep III at Hawara. Ancient scholars Herodotus, Strabo, and Pliny describe the temple pyramid’s courtyard. The Roman cemetery north of Hawara yielded the famous and unique Fayum Portraits.

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## federation

GEOGRAPHICALLY, a federation (from the Latin *foedus*, meaning “league,” “covenant,” or “alliance”) is a political system created by the voluntary association of distinct political units and formally established by treaty or compact. It is a system of dual sovereignty. Each unit maintains some form of independent administrative power or local identity and sovereignty. At the federal level, sovereignty normally is confined to group or international relations. Thus we have the united, but separate, states of America or the various independent countries of the EUROPEAN UNION, and the distinct provinces of CANADA and AUSTRALIA as well as 20 or more other countries as current examples. The former Soviet Union claimed to be a federation, but none of its parts had the de facto right of secession or of de facto local independence. Today, it is calculated that there are 21 countries that classify themselves as federal. And there are many economic and military associations that assume the same title, such as the United Nations and the NORTH ATLANTIC TREATY ORGANIZATION (NATO).

Any federation faces a continuing dynamic or struggle between separation of power and a need for unity on specific issues—economic, social or military. Regardless of the forces that created their formation, all federations eventually seek increased centralization and a reduction in the power of their individual units. Some scholars have claimed that only centralized federations last. Scholars consider there to be two basic types of modern federal associations: the original function of an alliance of pre-existing political groups or units and the newer use as a form of decentralization. Decentralizing federations occur when an existing centralized state begins to cede some power to local groups or areas—as with indigenous people or tribal groups.

Generally, federations consist of political entities that share proximity and preferably contiguous borders or territory. Their voluntary association is to increase their power. However, there have been maritime federations whose parts were widely separated, for example, the Greek CITY-STATES. These were more economic in motivation.

Regardless, the distinguishing characteristic and *raison d'être* of any federation is an association of distinct groups that have a strong sense of territorial identity. After the motivation of a need to recognize distinct ethnic and regional politics, it is a recognition of common interests and economies of scale, such as economics (trade), mutual military defense, or need of a unified power-grid or transport system that typically is the reason for maintaining a federation in the 21st century.

Modern examples of federations that reflect this range of motives would include the UNITED STATES, AUSTRALIA, SPAIN, INDIA, ARGENTINA, NATO, the EUROPEAN UNION, MALAYSIA, SWITZERLAND, and many countries in Africa and Central Asia.

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## Fertile Crescent

THE FERTILE CRESCENT, an area between the Tigris and Euphrates rivers, was called Mesopotamia by the ancient Greeks. This meant “the land between the rivers.” The Fertile Crescent extends from the eastern shore of the MEDITERRANEAN SEA to the PERSIAN GULF and gets its name from its shape. James Breasted, an archeologist from the University of Chicago, first called it the Fertile Crescent.

This region includes present-day ISRAEL, LEBANON, and parts of JORDAN, SYRIA, IRAQ, and southeastern TURKEY. It is believed that civilization first developed in this area, giving rise to the nickname “The Cradle of

Civilization.” Scientists think that agriculture began in this fertile valley around 8000 B.C.E. Here, tribes of nomads, who had formerly been hunters and herders, settled. Barley and wild wheat were abundant. Besides the rivers and the fertile land, the area had four of the five most important species of domestic animals: cows, goats, sheep, and pigs. The other species, the horse, lived nearby.

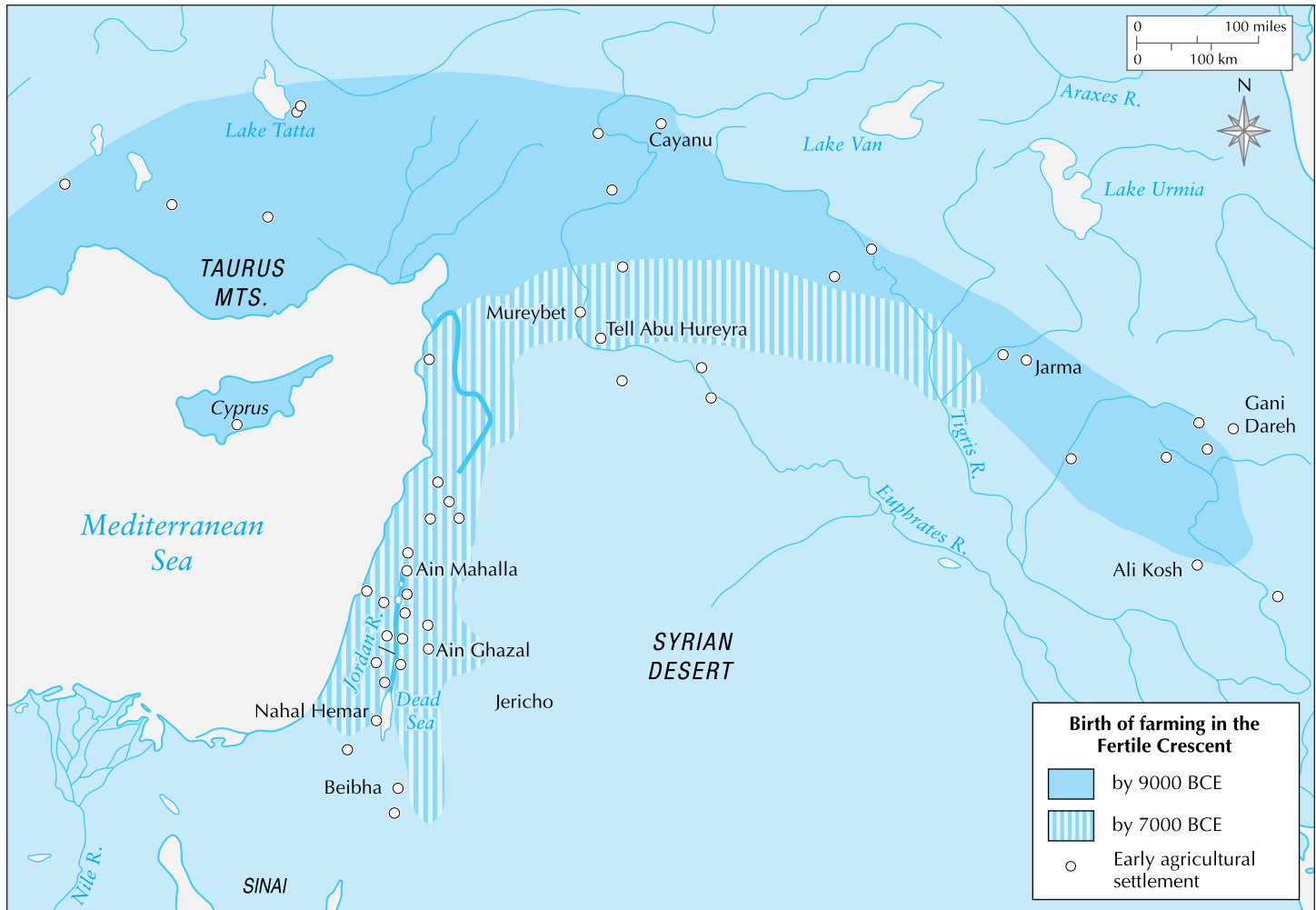
People began to move down from the mountains to the grassy uplands and plains in Mesopotamia. By 7000 B.C.E., farmers were planting wheat and barley and raising domesticated cattle and pigs. The climate of the Fertile Crescent encouraged the evolution of many new species of plants.

Primitive villages stretched across the strip from Assyria to the Euphrates River by 6000 B.C.E. People were learning to cooperate, and social organization grew out of this effort. They learned to irrigate their crops in the drier parts of the Fertile Crescent. By 5000 B.C.E., cities were being constructed in the southern part of the valley. The civilizations of Sumer, Babylon, Assyria, and Persia developed in the Fertile Crescent.

The Sumerians arrived in the Tigris-Euphrates Valley in about 3500 B.C.E. They came from Central Asia and settled in southern Mesopotamia. They took charge of the land and resources there and developed a complex civilization. The region became known as Sumer. Here, city-states developed, each ruled by a king. The king was in charge of construction of buildings and temples, maintaining irrigation systems, overseeing justice, and making trade and defense policies. At first, these kings were elected, but later their positions became hereditary. Because of the number of city-states, there was often tension and conflict among them. Conflicts were often over rights to water or land. Sometimes one city-state tried to conquer another.

The Sumerians invented the first known system of writing. Called cuneiform, it used a triangular-tipped stylus to make wedge-shaped marks in soft clay. The Sumerians also developed the arts of bleaching and dying fabrics and engraving. They developed surveying equipment and built dams and canals. The Sumerian number system influenced our astronomy and our method of timekeeping, with 60 minutes in an hour and 60 seconds in a minute.

In 2000 B.C.E., the Babylonians took control of the Fertile Crescent. One of their contributions was Hammurabi's famous code of laws. They had well-developed literature, religion, history, and science. Their number system was more advanced than the one we use today. From the Babylonians, we received modern



The ancient Fertile Crescent region includes present-day Israel, Lebanon, and parts of Jordan, Syria, Iraq, and southeastern Turkey. It is believed that human civilization first developed in this area.

astronomy and algebra. King Nebuchadnezzar built the Hanging Gardens of Babylon, one of the Seven Wonders of the World. The Babylonian Empire lasted until 538 B.C.E., when the last of the Babylonian rulers surrendered to Cyrus the Great of Persia.

Cyrus was succeeded by his son, Cambyses, who expanded the PERSIAN EMPIRE to include Egypt. After his suicide, Darius I came to power. He instituted a public works program, a postal system, road construction, and a system of minting coins. He also set up a system of weights and measures and built the palace at PERSEPOLIS, the royal center of his empire. It was located in southwestern IRAN.

The Assyrian Empire is hard to pinpoint. The Assyrians, a race of brutal warriors, lived in the northern part of the Fertile Crescent. The first Assyrian Empire lasted only about 50 years before it was assimilated

into the Babylonian Empire in 1760 B.C.E. The Assyrians came to power again in the 14th century and managed to extend their borders. From 1070 to 950 B.C.E., little is known about the history of Assyria, but from 950 to 609, when Assyria was overthrown, its history is well-documented.

The biggest contributions of the Assyrians were in the form of techniques of war and specialized equipment used to carry on war. Also, we still use Assyrian words today for many plants and minerals. Contributions by these early civilizations and others have influenced not only the Fertile Crescent area, but the entire world.

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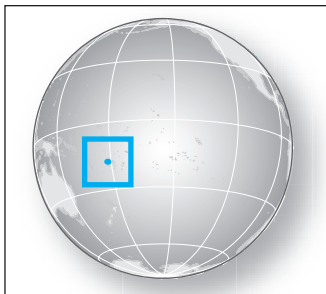


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## Fiji

**Map Page** 1128 **Area** 6,767 square mi (18,270 square km) **Population** 868,531 **Capital** Suva **Highest Point** Tomanivi 4,343 ft (1,324 m) **Lowest Point** 0 m **GDP per capita** \$5,600 **Primary Natural Resources** timber, fish, gold, copper, offshore oil.



THE REPUBLIC OF the Fiji Islands, a part of Oceania, is an archipelago in the South PACIFIC OCEAN, about one-third of the way from NEW ZEALAND to HAWAII. The island group consists of 332 islands (110 inhabited) and has a combined area somewhat smaller than NEW JERSEY. The islands consist mainly of volcanic hills and mountains that are lush in tropical vegetation. The climate is tropical maritime and is characterized by a dominance of warm, moist air masses, high levels of precipitation, cyclonic storms (November through January), and minimal seasonal temperature fluctuation.

Fiji has a high birth rate (23/1000 in 2003), a low death rate (5.7/1000 in 2003), a rapid rate of natural increase (1.7 percent), and a notable out-migration. Population density is moderate, life expectancy is fairly high (68.9 years), and the median age, only 23.7 years, is markedly lower than for North America. The majority ethnic group, Fijian (51 percent), is mainly Melanesian with a strong Polynesian influence. Minority groups include Indians (44 percent), who are mostly Hindu, Europeans, and other Pacific Islanders. Christianity is the primary religion among the Fijians and in the island group as a whole (52 percent), especially Methodism and Catholicism, followed by Hinduism (38 percent) and Islam (8 percent). English, the official language, is accompanied by Fijian and Hindustani. Education is free for young people ages 6 to 14, and national literacy is above 90 percent.

Fiji has a well-developed economy based largely on sugar exports, tourism, clothing, copra, gold, silver, lumber, and small cottage industries. Being insular, Fiji

has a long total coastline and adheres to international guidelines for the division of ocean waters. It claims a 12 nautical mi territorial sea and a 200 nautical mi Exclusive Economic Zone for resource development. Given its rugged terrain, only 10.9 percent of this island country is arable. Agriculture employs 17 percent of the official workforce and produces a range of commodities from sugar, cassava (tapioca), rice, and coconuts to sweet potatoes, bananas, pigs, and cattle. With this production, Fiji faces serious ecological issues such as deforestation, soil erosion, chemical contamination, and siltation of internal waters.

Fiji received its independence from the United Kingdom on October 10, 1970, amended its constitution in July 1998 to include national open voting, and today has an elected government. Poverty, subsistence living, political polarization between Fijians and Indians, and national fiscal management remain serious challenges. The country's executive branch consists of a chief of state or president and a head of government or prime minister. The parliament comprises a senate and house of representatives, and the supreme court oversees a legal system borrowed from the British. The country is divided administratively into four divisions, the northern, eastern, western, and central, and one dependency, Rotuma.

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## Finland

**Map Page** 1130 **Area** 130,500 square mi (338,000 square km) **Population** 5,190,785 **Capital** Helsinki **Highest Point** 4,426 ft (1,328 m) **Lowest Point** 0 m **GDP per capita** \$30,496 **Primary Natural Resources** timber, metals arable land.



AS CITIZENS OF the northernmost country in Europe, the people of Finland have long experienced the

effects of their nation's absolute and relative location. Finland spans approximately 690 mi (1,104 km) from the 60th parallel in the south to the 70th parallel in the north with approximately one-third of the country falling above of the ARCTIC CIRCLE. While the climate of Finland is moderated by the effects of the Baltic Sea, it is nonetheless greatly determined by its high latitude. The mean annual temperature of its capital, Helsinki, is only 41 degrees F (5.3 degrees C) with an average July temperature of 62 degrees F (17 degrees C) and February temperature of 22 degrees F (-5.7 degrees C).

### PHYSICAL GEOGRAPHY

The physical geography of Finland has also been greatly shaped by its absolute location as a result of continental glaciation that once covered large portions of northern Europe. As the ice advanced and retreated across the landscape, it carved the southeastern portion of Finland into a patchwork of shallow lakes, giving Finland its nickname, Land of a Million Lakes. The movement of ice sheets was never constant, and in their retreat they remained stationary three times, depositing rock and sediment debris to form moraines and drumlins. Stream flow beneath the glaciers deposited additional material, thereby forming ESKERS that stretch from east to west across the country and are called the Salpauselkä ranges. With the retreat of the ice approximately 12,000 years ago, the land itself reemerged from the sea, freed from the immense weight of the glaciers. This process continues today, with the land area of Finland increasing by approximately 2.7 square mi (7 square km) annually.

The postglacial landscape combined with the high latitude provide the basis for a natural environment predominated by boreal forests in the south and low-lying scrub vegetation in the northern reaches of Lapland. As a natural resource, the forests of Finland play a significant role in the economy of the nation with the development of lumber and paper industries. With significant governmental intervention in the 20th century, the Finnish wood industries have worked to increase timber harvests while conserving forested land in the interest of recreation and other nonindustrial uses.

The forests have also been long associated with the development of Finnish culture. Although Finnish society first developed with agriculture, the forests continued to represent a store of wealth for the inhabitants with their abundant flora and fauna. The natural resources of Finland also caught the attention of growing European empires. With the expansions of the Vikings eastward toward RUSSIA, the people of Finland were

eventually incorporated into the Kingdom of SWEDEN and converted from their preexisting pagan beliefs to Roman Catholicism. With the development of the Great Schism and eventual adoption of Orthodox Christianity in Russia, Finland became a religious and imperial battleground between East and West. For approximately 800 years, the majority of contemporary Finland remained within the domain of the Kingdom of Sweden, even converting to Christian Protestantism with the arrival of the Reformation. But after multiple wars and several tenuous periods of peace throughout those centuries, control of Finland was transferred to the Russian empire in 1809.

As an autonomous grand duchy under the control of the Russian czar, Finnish governmental organization remained relatively unchanged and experienced, at least for a brief span of time, an unprecedented period of peace free from the wars that had plagued its people for centuries.

With the demise of the Russian Empire in 1917, Finland sought its own independence and the Republic of Finland was declared. The transition to independence was not without conflict, however, and the people of Finland were embroiled within a civil war between the Reds and the Whites, both of which sought control of the new nation. Less than 20 years later, Finland was once again engaged in conflict, this time caught in the power struggle between GERMANY and the Soviet Union in World War II. The conclusion of the war ultimately resulted in the loss of eastern Finnish territory in the region of Karelia to the Soviet Union.

### WELFARE STATE

Despite the devastation of World War II, throughout the latter half of the 20th century, the democratic government of Finland has invested heavily in both the economy and its citizens, evolving into a Scandinavian welfare state that operates on the premise that the role of government is to care for its citizens from "cradle to grave."

While Finland experienced some economic struggles in more recent decades, its economy has been revived by the growth of high-tech industries within its borders, including companies such as mobile telephone communication giant Nokia. The people of Finland have embraced technology as a globalizing force that allows a country long isolated linguistically and physically to become more integrated into the world economy.

These events, combined with membership in the EUROPEAN UNION in 1995 and the adoption of the euro

as its currency unit in 2002, served to further increase the impact Finland and its people will have upon the rest of the world.

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## floodplain

FLOODPLAINS HAVE been a focal point of settlement throughout history and of controversy in recent decades. Humans are drawn to floodplains to cultivate the fertile soils that compose them. Floodplains are some of the best lands for growing crops, but they come with a price. Sometimes, rivers exit their banks and inundate the flat lands and everything on them.

A floodplain is defined as a strip of relatively smooth land bordering a stream that overflows at time of high water. Floods build up the bordering plains with organic-rich sediments. While flooding is sometimes disastrous for humans, it is necessary in the development of floodplains. Rivers create floodplains over thousands of years through two processes, vertical and lateral accretion.

Vertical accretion is the deposition of sediments like sand, silt, and clay from floodwaters. As floodwater spreads out over a flood plain, it slows down and loses energy. As energy is lost, sediments held in suspension drop out and are deposited on the plain. The heaviest sediments, like sand, are the first to be deposited and accumulate near the river channel to form a natural levee. Lighter sediments, like clay, stay in suspension longer and are deposited further away from the river in areas called back marshes.

Lateral accretion is the deposition of sediments to the inside curve of river meanders. As water flows around a curve, the current is fastest on the outside and erodes sediments to create a cut bank. The current on the inside of the curve is of low energy and suspended materials drop out. In this way, point bars are created as the river moves laterally. Because of this, land on one side of the river may be much younger than that of the other.

Today, natural floodplain processes have been largely interrupted in the UNITED STATES. Large networks of artificial levees have been constructed to protect crops and property from flood damage along many of the country's rivers. While flooding is decreased, so is the natural fertilization of soils. Thus, farmers have to apply artificial fertilizers to sustain crop yields, adding to pollution.

The effectiveness of flood control levees is now being questioned. While flooding has been decreased, it is becoming apparent that the severity of floods that do occur is being increased. As more levees are built, less floodplain area is available for rivers to spread over; this means that more water is confined between the levees.

When a levee is breached during times of high water, the result is massive local flooding rather than normal flooding over a broad expanse. Steps are now being taken to curb the flooding problem. Floodplain lands are being purchased and returned to their natural cycles. This effort relieves pressure between the remaining levees and lessens the necessity to continually increase the height of levees.

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## floods

OF ALL THE NATURAL hazards in the world, floods are the most widespread. Historically, floods have killed more people and caused more damage than any other type of natural disaster. A flood is defined as an overflowing of water on an area that is normally dry. There are several types of flooding, including river flooding, coastal flooding, urban flooding, inland flooding from hurricanes, and flash flooding. Each has its own causes and characteristics, but all can be deadly and floods can happen anywhere.

Throughout history, people have always built their towns and cities near water, both along the seacoast and along rivers further inland. The water serves many purposes. It is used for drinking, cooking, and bathing. Water in many places has been used as a source of power, to turn wheels that grind grain. Running water is similarly used to create hydroelectric power. Another reason for settling close to water is that it has always been an easy way to travel and to transport goods. The disadvantage of living near water is the possibility of flooding.

The amount of water on Earth is fairly constant all the time. Each day, some of the water on the Earth is lost into the atmosphere through the process of evaporation. Water in rivers, lakes, and oceans is always evaporating at a slow rate. Most water on the Earth is in the form of liquid, but at the poles we find water in its solid or ice form. Water in glaciers is also in the form of ice.

At some places, water is in the form of water vapor in the air. This is the water that has evaporated from the surface of a body of water. A water molecule remains in the atmosphere for approximately 9 or 10 days before it falls as rain or snow. This happens when the amount of water in a cloud becomes heavy enough to form drops of water, which then fall to Earth. Rain that goes into the bodies of water begins the cycle again. Some rain will soak into the ground, where it will spend some time as groundwater.

River flooding is one of the most common types of flooding. It occurs when rainfall throughout the year is unevenly distributed. Too much rain goes into the river at one time and the water exceeds the capacity of the channel. When that happens, the stream will overflow its banks. Another cause of river flooding is melting snow in the spring. In areas with hills or mountains, the snow in the higher elevations melts and the water runs down into the streams. If the snowfall was heavier than usual, floods may occur. Also, spring rains often occur at the same time as the snow is melting, contributing more water to the streams and rivers. The torrential rains that accompany a hurricane or other tropical storm can also cause flooding in rivers.

When heavy rains fall on bare soil, it is churned into mud. This keeps the water from soaking into the ground, and most of it will flow across the surface of the ground, creating gullies leading to rivers and streams.

Coastal flooding occurs when ocean water is driven inland by winds from tropical storms or hurricanes. Sometimes escape routes are blocked by this

high water and people cannot escape. Coastal flooding can also be caused by a tsunami, which is a sea wave sometimes referred to as a tidal wave. These huge waves are caused by volcanic activity or an earthquake.

When urban flooding occurs, the streets in a town become swift rivers and basements fill with water. This is partly due to the fact that land that used to be fields or woodlands has been converted to roads and parking lots. The concrete or asphalt cannot absorb any rainfall and it runs off the surfaces of the parking lots and roads.

### FLASH FLOODS

Flash flooding is flooding that was not expected. Flash floods are the most dangerous of all floods because of the element of surprise. Intense rainfall over a significant period of time can cause flash flooding. The speed with which a flash flood can occur makes it even more dangerous. Flash floods often occur in dry areas where the ground is baked hard. When torrential rains do come, water immediately fills arroyos, or dry stream beds, turning them into raging rivers. The torrent of water rushes through with enough force to wash away sections of concrete road.

Flash flood waters move very quickly and can move boulders, tear out trees, and destroy bridges and buildings. Sometimes a wall of water 10 to 20 ft (3 to 6 m) high carries a huge amount of debris. The worst flash floods are created when a dam or levee breaks and a huge amount of water suddenly pours downstream, destroying everything in its path.

Inland flooding has been the number-one cause of deaths from hurricanes in the past 30 years. In 1999, Hurricane Floyd caused 56 deaths. Fifty of them were people who drowned due to inland flooding. Inland flooding occurs when a slow-moving storm is accompanied by heavy rains. Inland flooding is a threat to communities hundreds of miles from the coast. Over a third of the people who drown during an inland flood are in their cars. Some are trying to escape the flooding, while others are attempting to abandon the cars. Even a foot of water can cause a car to float, and if that water is rushing down a street, the car can be swept away.

All kinds of floods cause problems for people. The worst consequence of floods is loss of lives. Property damage is a major problem with flooding. Houses can be completely demolished or even carried away down a turbulent river. Even houses left standing after a flood usually have substantial water damage and some have structural damage as well. Also, when the water sub-



sides, it leaves behind a thick, sticky coat of mud filled with debris. So even if there is no structural damage, cleaning up after a flood is a big job.

Floods can also spread disease. Water flowing through an area can pick up chemicals and waste products and move them to another place. Most diseases are more easily spread through water than through air. That is one reason it is so important for those in a flooded area to drink only bottled or boiled water.

Besides damaging homes, floods can cause other problems to agricultural areas. Soil can be eroded and crops already in the fields can be ruined. Floods also damage reservoirs and rivers where they deposit the load of soil the water picked up from the fields.

### SEASONAL FLOODING

In some areas, flooding is an annual occurrence and is expected. Seasonal flooding like this took place every summer for thousands of years along the NILE RIVER in EGYPT. The monsoons caused hard rains at the source of the river which filled the river channel to overflowing. This made the land along the banks of the river very fertile in an area of desert. This is one of the few positive results of flooding. In most areas, though, people want to prevent floods from happening. Many solutions have been attempted. In LOS ANGELES and other big cities, concrete channels have been constructed. When there is a lot of rain, the water goes into the channels and is carried out of the city. Here the land can absorb the water that could not be absorbed by the concrete and asphalt ground coverings in the city.

Levees, or large walls, have been built along the edges of rivers to keep them from overflowing. They are high enough so that much more water can flow through the channel. They are fairly effective in the areas in which they are built, but they result in much more water being carried downstream, and this causes problems for areas with no levees. All the water that would have been spread out upstream now floods a larger area than it would have. Also, the sediment that used to be deposited over the whole floodplain builds up in the river bottom, causing the riverbed to rise. Then it can contain less water. Levees can break, too, and when that happens, a flash flood occurs, endangering all who live near the river.

### DAMS AS FLOOD CONTROL

Dams are sometimes used for flood control as well. When they are built near the headwaters of the stream, they can be made to retain heavy runoff, and the water can then be released gradually during dry periods.



*Rescue workers search for survivors and bodies after the Johnstown flood in 1889 in Pennsylvania.*

Floodways are another way of controlling floodwater. This principle diverts floodwaters into a controlled area so that other areas are not flooded. Reforestation can help in areas where flooding occurs because the forests have been cut and the soil eroded.

Preventative measures have also been taken to prevent coastal flooding. These measures have not been as successful as the dams and levees on the rivers have been. Fences and walls are sometimes built where the water meets the land, in an attempt to lessen the power of the waves and keep them from wearing down the beach. However, such structures also interfere with beach formation. Walls and fences often do not work because of the overpowering force of the ocean. In an attempt to prevent flooding on beaches and the resulting erosion and loss of sand, some groups have tried pumping sand from deep waters onto the beaches. This

works for a while, but is expensive. Breakwaters are also built offshore in order to intercept the waves before they hit the beach, but they are an eyesore.

Probably the worst flood in the United States was the Johnstown flood in 1889. Johnstown, PENNSYLVANIA, was a steel town, built on the floodplain at the fork of the Little Conemaugh and Stony Creek rivers. To prevent flooding, a dam had been built 14 mi (22.5 km) up the Little Conemaugh. The South Fork Dam held back a three-mile-long lake on the side of the mountain, 450 ft (137 m) higher than Johnstown. The dam had been poorly maintained. On the afternoon of May 31, after a night of torrential rains, inhabitants heard a “roar like thunder.” Some immediately realized that the dam had broken. Twenty million tons of water rushed down the narrow valley to Johnstown, carrying with it tons of debris from the dam. The wall of water was at times up to 60 ft (18 m) high and leveled everything in its way.

Thousands of people tried to get out of the way of the water, but many were swept downstream with the debris. Some of these people made it downstream to the old Stone Bridge, where the rivers met, by clinging to debris that served as rafts. However, much of the debris caught fire when it hit the bridge. Eighty people who had managed to cling to something as they were swept downstream then died in the fire. Many of the missing were never found, and many bodies could not be identified. The cleanup took years, and bodies were found months after the flood.

Floods on the HUANG (Yellow) River, in CHINA have killed more people than the flooding of any other river in the world. Almost 2 million died in the flood of 1887, and almost twice that many were killed by the flood in 1931. In 1938, there were almost a million casualties. The channel of the river is choked by millions of tons of yellowish mud, which causes the river to overflow often and to change course. In some areas, the river bed is actually higher than the surrounding countryside. Dikes have been built, some as high as 30 ft (9 m) but they don't always hold. For centuries the Chinese have tried to control the river by building levees and dams and digging channels. A huge new dam called the Xiaolangdi Multipurpose Dam was being built in the 2000s. With 10 intake towers, nine flood tunnels, six power tunnels, and an underground powerhouse, the Chinese hope this will finally alleviate their problems with flooding.

As noted earlier, the Nile River floods like clockwork every summer. For many years, the Egyptians took advantage of the flooding. Recently, though, they

have been forced to grow more crops to feed their growing population. In 1970, Egypt built the Aswan High Dam across the Nile 600 mi (965 km) south of Cairo. The dam has stopped the flooding by trapping the water in a reservoir. It is then released during the dry season. This has increased the length of the growing season, as farmers no longer have to wait for the annual floods to recede before planting their crops. However, the land is not as fertile now that the fields aren't flooded annually, so farmers must use large amounts of fertilizer.

The MISSISSIPPI RIVER has regularly flooded its banks for thousands of years. A disastrous flood in 1927 killed 246 people in seven states. It flooded 16,570,627 acres (6,705,894.8 hectares) and caused over \$400 million in damage. This prompted the government to try to tame the river. The U.S. Army Corps of Engineers went to work building the longest system of levees in the world. Today, the Mississippi has 29 locks and dams, and miles of levees, as well as hundreds of runoff channels. Most of the time the system works very well, but in 1993, 80 percent of the private earthen levees on the river failed. Most of the federal levees held, but torrents of water still poured down on fields and towns.

Flooding is more disastrous in less developed countries for several reasons. There is a lack of flood control in most of these countries, and the people don't have an emergency response system in place. Many don't have the technology to put out or receive early warnings. Flooding in the UNITED STATES kills far fewer people today than it did a hundred years ago. Early warning systems are in effect, and meteorologists are much better able to predict floods. Almost everyone has a television set and can learn of an imminent flood in time to take safety measures. Most cities have disaster plans, complete with evacuation routes to be used in case of flooding. Also preventative measures such as levees, dams, runoff channels and breakwaters work reasonably well and make it unlikely that a flood of the magnitude of the Johnstown flood or the 1927 flood on the Mississippi will occur.

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## Florida

"THE SUNSHINE State," covering an area of 58,560 square mi (151,714 square km), is the most southern state of the UNITED STATES and is mainly a large low-lying peninsula, measuring from north to south about 430 mi (690 km), bounded by the ATLANTIC OCEAN on the east, the Gulf of Mexico on the west, and the Straits of Florida on the south. The state's northern border is bounded by the states of GEORGIA and ALABAMA. Alabama also bounds the Panhandle's western border. Florida includes the Florida Keys, a chain of islands extending southwesterly from Biscayne Bay at the southern end of the peninsula, and many barrier islands line the coasts. Many of these keys and barrier islands are small and uninhabited. The state's highest point, the Western Highlands of the northern Panhandle, is 345 ft (105 m) above sea level.

Despite popular conception, Florida is a land of geographic diversity. Northeastern Florida is like much of the state, predominantly flatland of hardwood forests and slash pine flatwoods, dotted with the saw palmetto. Riverbanks are lined with mighty live oaks laden with Spanish moss. The northeast's prominent geographic feature is the surprisingly wide and deep St. Johns River, in which dolphins play under bridges.

The Panhandle, with the capital city of Tallahassee and the coastal town of Panama City, is low rolling hills and farmland characteristic of the Deep South. The peninsula, composed of central and south Florida, includes open forests, citrus groves, GRASSLANDS, freshwater swamps, lakes, and open vistas, with tropical hardwood forests or hammocks in the south. The chief city of central Florida is Orlando. Tampa and St. Petersburg, both at the huge Tampa Bay, are the urban center of the Gulf Coast of the peninsula. South Florida's largest city is Miami. The most notable geographic features in the south are the Everglades, a massive area of WETLANDS and perhaps the most endangered ECOSYSTEM in North America, and Lake Okeechobee. The Everglades National Park includes 1.5 million acres (566,580 hectares) and occupies only one-fifth of the Everglades.

Florida's over 1,000 mi (1,600 km) of wide and sandy beaches, such as those at Daytona, Destin, Miami, and Fort Lauderdale are among of the most beautiful and famous in the world. These vary from powdery white sand to crushed shell and coral. Windswept dunes flank many, while other beaches to the south are lined with stately royal palms. The Gulf beaches are known for their warm emerald water in contrast to the thunderous waves of the east coast. The Atlantic seaboard is fringed by 800 km (500 mi) of the Intracoastal Waterway, a long and narrow haven for pleasure craft.

The northern half of the state contains over 320 pristine freshwater springs, recharged by heavy rainfalls. Labyrinths of subterranean rivers connect many of these springs, some opening to the sea. Another curious feature of the northern half of the peninsula is the sinkholes formed from the erosion of the limestone bedrock. These depressions led to the formation of many of the state's over 30,000 lakes and ponds and have often appeared suddenly to swallow cars and homes.

Much of Florida's interior remains wild and undeveloped, and about 50 percent of the state is covered in forest, with about half of that commercial. Its groves produce over 70 percent of the citrus fruits consumed by Americas annually, most notably oranges. The sugarcane, vegetable, cattle, and lumber industries thrive in the state's geography and climate. This diversity of landscape and warm climate, where the temperate zone meets the subtropical, affords an abundance of natural habitats supporting animal life as diverse as the alligator, bobcat, bear, deer, bald eagle, manatee, and the elusive Florida panther.

The state is a major tourist destination thanks to its beaches, good weather, fresh- and saltwater sport fishing, and ever-expanding family attractions extending around the Walt Disney World Resort near Orlando. The usually clear weather also attracted the placement of the Kennedy Space Center at Cape Canaveral; the good weather is punctuated by occasional yet sometimes devastating hurricanes, such as Hurricane Andrew in 1992.

Sparsely populated for most of its history, Florida now struggles with rapid development, urbanization, and population growth, with a population in 2000 of 15,982,378. The state has a colorful and diverse cultural life, ranging from the Deep South atmosphere in the north to the Cuban influence in the south. The few remaining Seminole strive to maintain their culture in the south.



## DISCOVERY AND DEVELOPMENT

Florida has a rich history shaped by its strategic position and geography. It served as Europe's first frontier in North America and a bloody battleground between the Spanish and French empires. The peninsula, although first thought to be an island, was discovered for Spanish exploration and colonization, and corresponding exploitation of its native population, on April 2, 1513, by Juan Ponce de León. It is believed that his landing was near the site of Melbourne Beach on the ATLANTIC OCEAN. Legend says de León sought the fountain of youth, but he was more certainly in search of gold. He named the low expanse of land on the horizon "La Florida" (land of flowers).

Pedro Menéndez de Avilés founded North America's first permanent European settlement, St. Augustine, at Matanzas Bay on Florida's northeastern coast in 1565. Menéndez captured a settlement of French Huguenots at Fort Caroline, at the mouth of the St. Johns River, and later executed the members of a shipwrecked French expedition at the Matanzas Massacre. FRANCE no longer posed a serious challenge. At St. Augustine, a garrisoned town and fort was built to protect the Spanish treasure route, to provide a site for rescuing frequently shipwrecked Spaniards, to serve as a base of coordination for missionary and inland exploration efforts, and maintain Spain's claim to the region. Nevertheless, the St. Augustine settlement was subject to raids by pirates and English privateers, the most famous led by Sir Frances Drake in 1586, in which the town was burned.

In response to pirate and British threats, the construction of a stone fort, Castillo de San Marcos, was started at St. Augustine in 1672. This imposing structure, which still stands, was built from a remarkable sedimentary limestone rock called coquina, which is easily cut when soaked. Coquina is formed from compacted seashells and corals, and was quarried on nearby Anastasia Island. The then state-of-the-art fortress, with its moat, watchtowers, drawbridge, thick walls, and ramparts that swallowed enemy cannonballs without shattering, withstood major pirate and English assaults. From the secure foothold of Florida, Spain's conquistadors led expeditions probing the North American continent, the most famous led by Hernando de Soto.

Except for a period of British rule from 1764 to 1783, during which royal botanist William Bartram recorded Florida's fauna, flora, and native peoples, Florida was a Spanish colony until ceded to the UNITED STATES by a treaty of 1819, with formal transfer in

1821. Statehood was achieved in 1845; thus making Florida the 27th state. The population of the state remained concentrated in the north and the Panhandle until railroad lines were constructed down both coasts, even connecting the Florida Keys, by railroad barons such as Henry Flagler. These lines spurred tourism, development, and periodic real-estate booms.

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## footloose industries

THE IDEA OF FOOTLOOSE industries has changed along with the transformation from an industrial to a postindustrial economy. The core concept remains the same, however: A footloose industry does not have a strong locational preference because the resources, production skills, and consumers on which it depends can be found in numerous places. Such a company may therefore be more prone to relocation, hence the term *footloose*.

Footloose industries became prevalent in geographic parlance during the quantitative approach in geography from the 1950s onward. Economic geographers interested in industrial location borrowed ideas and methodology from neo-classical economics. The basic premises of footloose industries are derived from the work of German economist Alfred Weber, who was probably the first to theorize on the location of industries in the beginning of the 20th century.

First, we must assume that the most important factor in industrial location is the cost of transportation (however, this is less and less true over time). Some industries may have a strong resource orientation, that is,



if the raw material used in a production process is heavy and bulky in character, it makes sense to be located close to those natural resources. Heavy manufacturing districts around the world (e.g., the steel industry in northeastern United States) are usually located near major coal deposits. Such a resource-oriented location is often combined with good access to important transportation routes.

Other types of manufacturing can be market-oriented. (Traditionally, the footloose concept has been applied in manufacturing, once the dominant sector in the economy.) Let's take the example of a dairy. If we assume that cows can graze just about anywhere and that milk is a perishable commodity, dairy production should be located close to the consumers the industry serves. For both resource and market orientation, the locational choices of industries are limited, or dressed in more theoretical language, and the so-called spatial margins to profitability are narrow. The opposite is true for a footloose industry. If raw material is easily accessible in numerous locations, markets are dispersed, and the physical properties of the commodity are such that transportation cost makes up a small portion of total cost, the locational choice is much greater.

### INFORMATION FLOW

The locational logic described so far has become less powerful over time for a couple of reasons. Relative transportation costs have declined, which in effect expands the spatial margins to profitability for an increasing number of industries. Moreover, the contemporary postindustrial economy is more and more characterized by flow of information and people rather than bulky goods, which has made traditional transportation cost-based location analysis less relevant. The Internet and other forms of advanced communication technology are said to make location completely detached from both resource and market considerations.

The growth of footloose industries has some strong implications. Cities and regions that once occupied a relatively secure position in the national and global economy because they harbored few industries that could be characterized as footloose are now thrust into an economic environment that is much more insecure. Capital is more mobile where both existing industries relocate and new investment flows to previously bypassed areas. To cope with this reality, local governments increasingly offer incentives to lure footloose industries. Such incentives include tax subsidies, land to build on, and infrastructure accommodations. Not

to be outcompeted by their neighbors, other cities answer with similar measures, which have brought an era of unparalleled interurban competition. As cities are more dependent on the capacity to capture mobile capital, urban policy has inevitably been more business-friendly, and business interests have strengthened their position in urban governance. Cities are even spending significant money to present themselves as good locations for footloose industries by marketing and advertising.

But as cities often offer similar economic incentive packages, location decisions may be determined by other factors. Footloose industries are more likely to locate in places with a perceived high quality of life (i.e., cultural, recreational, climate, educational amenities), where a productive workforce can be attracted. On the other hand, the idea that relocating companies always look for the lowest-cost location has been challenged. For several reasons, industries may not be as footloose as sometimes portrayed. They usually have significant investments in physical infrastructure, they are dependent on local skills and capacities that have been built up over time, and they may share resources and support services with other companies. The high-tech industry is sometimes considered a typical footloose industry because it is neither resource- or market-oriented. However, it tends to cluster for some of the above reasons and thus is not a good example of a contemporary footloose industry.

### GLOBALIZATION

A city's strategy is usually not to attract the most footloose of industries, because they often also produce the lowest-paying jobs. However, the situation is different from a global perspective. With the globalization of the economy, the spatial margins to profitability have widened to encompass large areas of the world. Particularly in industries that are labor intensive, where the products have high value per weight unit, and free trade is the norm, the propensity to frequently seek out new production sites is strong. The clothing industry, for example, is such a footloose industry that has developed a truly global pattern. If companies have the option to outsource much of their production, labor relations are also altered, circumscribing the bargaining position of labor in the United States and other developed nations.

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## forests

FORESTS COVER approximately 27 percent of the ice-free surface of the Earth, 13 million square mi or 34 million square km. The world's forests mainly occur in two broad zones: one centered in the tropical regions, the other in the Northern Hemisphere between 32 degrees N and 45 degrees N latitude. Globally, forest composition and distribution are influenced by precipitation and temperature. Soil, landform, and historical factors (for example, glaciation, natural and human disturbance) influence forest structure and composition on a local scale. Forests are generally absent from areas of low or strongly seasonal precipitation, including dry zones at the west side of continents and interior continental regions where annual precipitation is less than .29 in (.75 cm). The 50 degrees F (10 degrees C) isotherm marks the limit of tree growth in the Northern Hemisphere.

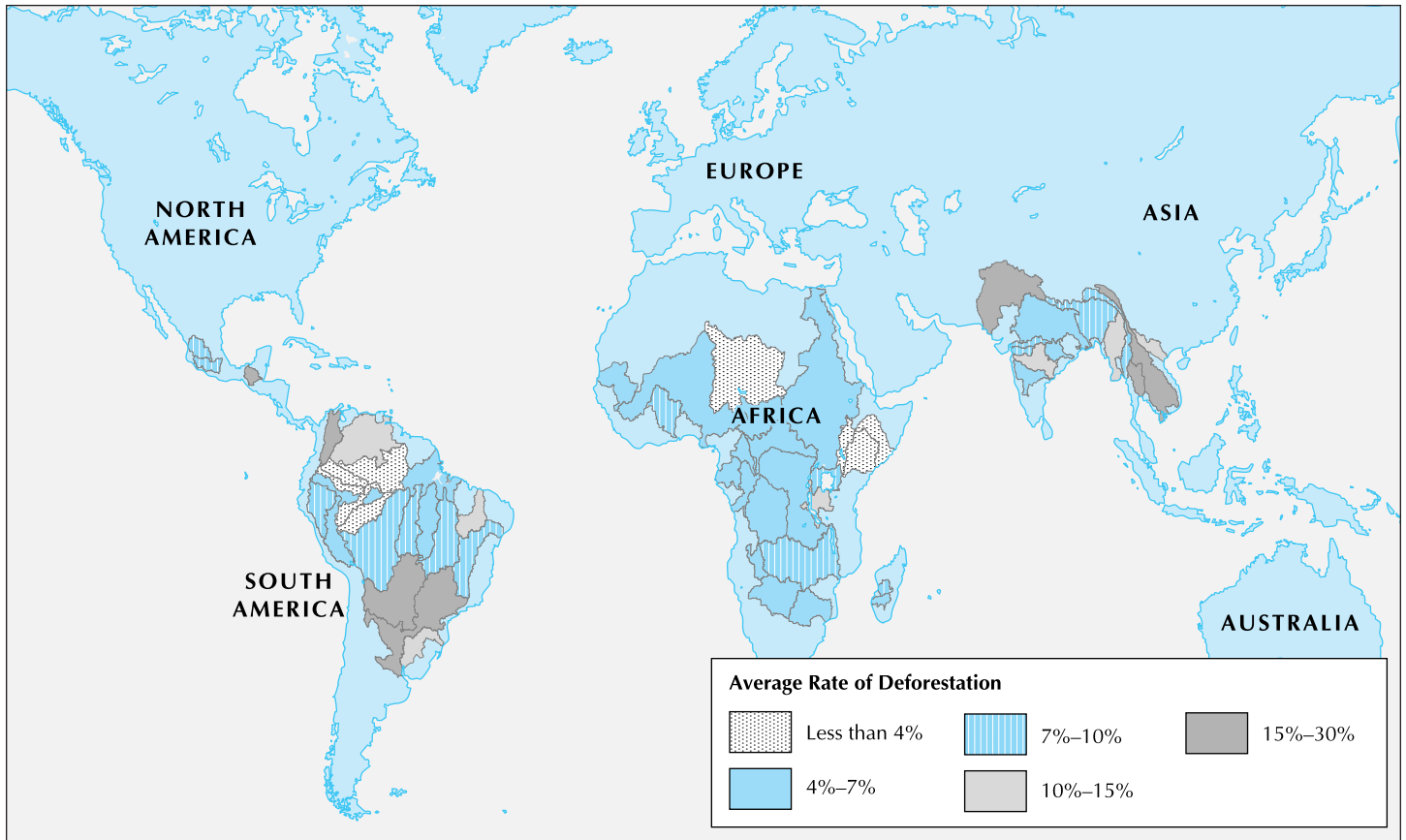
Forests can be classified into major types by LATITUDE, by amount and seasonal distribution of precipitation, or by macroclimate. Three forest types are recognized by latitude: tropical, temperate, and boreal forests. Tropical forests occur in the region bounded by the TROPIC OF CANCER and the TROPIC OF CAPRICORN, where frost is absent and rainfall is abundant but sometimes seasonal. Plants typical of tropical forests, like palms, generally do not occur beyond the 64 degree F (18 degrees C) isotherm. Temperate forests occur at mid-latitudes with warm summers and cool winters. Important temperate forest areas include eastern North America, Central and West Europe, and Northeast Asia. Smaller areas of temperate forest occur in CHILE and ARGENTINA, Southeast AUSTRALIA, and NEW ZEALAND. Boreal forests are restricted to the Northern Hemisphere and generally occur between 50 to 60 degrees N. Extreme winter temperatures, some exceeding -86 degrees F (-30 degrees C), select for cold-tolerant conifer species.

Forests can be further classified by their physical appearance (physiognomy) based on tree architecture

and growth form or by the composition of their dominant species—floristics. Physiognomic classification is often applied at large scales (biomes, ecological regions) while floristic classification is typically applied at local scales. Forests can be grouped based on leaf characteristics into broad-leaved or needle-leaved forest and by leaf phenology (whether leaves are shed seasonally or retained) into deciduous or evergreen forest. Since leaf characteristics are influenced by climate, especially the seasonality of temperature and precipitation, modern classification systems join macroclimatic information and physiognomy to identify forest types.

Two macroclimate domains (groups of ecological regions with similar climate) support forests: the tropical and temperate domains. Tropical domain forest types include tropical and subtropical evergreen broadleaf forest, tropical and subtropical broadleaf deciduous forest, and mangrove forest. Tropical evergreen forests—RAINFORESTS—usually occur between the equator and 10 degrees N latitude, where rainfall is heavy and average annual temperatures approach 80 degrees F (27 degrees C). These forests are multilayered, with numerous vertical vegetation strata, and are composed of species with little cold or drought tolerance. Several types of tropical evergreen forest are recognized including lowland forest (trees greater than 98 ft or 30 m tall, sparse undergrowth, and abundant epiphytes); montane forest (trees less than 98 ft or 30 m tall, an undergrowth of tree ferns, and a rich ground layer of herbs and mosses); and cloud forest (gnarled tree canopy less than 98 ft or 30 m tall, many lianas and epiphytes, and a rich ground layer of mosses, herbs, and ferns). Tropical deciduous forests, in which canopy trees shed their leaves during the dry season, occur where rainfall is seasonal. Mangrove forests grow in tropical and subtropical intertidal zones and are composed of evergreen, salt-tolerant trees less than 98 ft or 30 m tall.

Temperate domain forests include both temperate and boreal elements and are of three types: broad-leaved deciduous forest (leaf fall occurs in autumn and trees are dormant in winter); needle-leaved evergreen forest dominated by conifers; and broad-leaved evergreen forest. Broad-leaved deciduous forest of the northern temperate zone is dominated by oak (*Quercus*), maple (*Acer*), beech (*Fagus*), ash (*Fraxinus*), and lime or basswood (*Tilia*). Broad-leaved deciduous forest of the Southern Hemisphere (Patagonia, AUSTRALIA, Tasmania, and New Zealand) is often dominated by southern beech (*Nothofagus*). Needle-leaved evergreen forest occurs in a broad circumpolar belt in the North-



Deforestation, the sustained removal of trees, is usually a result of human activities, including clearing land for commercial development, cutting wood for house building, making paper, road construction, and clearing of land for growing crops and grazing animals.

ern Hemisphere and in temperate montane areas like North America's Pacific Northwest. Dominant tree species include spruce, fir, and pine. Temperate broad-leaved evergreen forest, the Valdivian and Magellanic rainforests, occurs on the western ANDES' wet slopes. Evergreen southern beeches are common in the canopy; trees may exceed 164 ft or 50 m in height.

Today, virtually all the world's forests are under pressure from a burgeoning human population that consumes land, fuel, and forest products at a rapid rate. Globally, a balance between forest protection and development must be struck to ensure that the ECOSYSTEM services that forests provide will continue to benefit life on Earth.

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## fractal geography

IN *THE FRACTAL Geometry of Nature* (1983), Benoit Mandelbrot writes, "Clouds are not spheres,

mountains are not cones, coastlines are not circles, and bark is not smooth.” In an effort to more properly analyze and represent nature mathematically, Mandelbrot developed a new geometric pattern called a fractal. There are various definitions for the complex structure of a fractal, but in general, it is a repeated geometric pattern at progressively smaller scales, which “produce irregular shapes and surfaces.” Mandelbrot outlined four properties of fractals: their dimensions, which are greater than the space they occupy; their “infinitely complex structures”; their quality of “self-similarity”; and finally, he describes a fractal pattern generated by macro iteration.

Mandelbrot’s impetus for creating a new geometrical application for nature’s irregular surfaces stemmed from a theoretical question about measuring coastlines. A coastline, when examined in its entirety from a position above the Earth, may appear nearly straight. Imagine picking a center position on such a coastline and moving closer, like a camera, frame by frame. Within each frame, the perimeter of the coastline changes, revealing more nooks, twists, rough angles, and many other irregularities. Now imagine examining the smallest point of coastline visible with the naked eye—perhaps a centimeter or slightly smaller portion of the coast. Even here, the sand, rock, or other soil formation will produce angles and indentations, which would require measurement to record accurately the length of the coastline. Place that small sample of coastline under a microscope, and it becomes even clearer that although the area of the coastline never changes, the perimeter infinitely changes with each iteration, or repetitious movement, closer to a particular point on the coastline.

This example illustrates the main properties of fractals and why using fractals is a key measuring and modeling tool for geographers. A circle that never changes size or shape can surround a fractal, but when magnifying the fractal, the complexity of perimeters only becomes greater—it is infinitely complex. A fractal retains its complexity no matter how many times it is magnified, and in fact, with each magnification, it technically becomes more accurate. Returning to the coastline example, each magnification reveals the inaccuracy of the first hypothesis that the coastline was relatively straight.

What is important is that because of the infinite nature of fractals and the irregular structure of nature, an element of chaos or randomization can be included into fractal formulas, allowing for an accurate yet approximate measurement.

One quality that many fractals have, which a coastline does not, is “perfect self-similarity.” Computer- and mathematical-generated fractals will often reveal the exact same image at every level of magnification. The perfect self-similar fractal is composed of smaller versions of itself, although there are fractals, including the Mandelbrot Set, that do not create the same image at every iteration, but smaller versions are revealed with close examination. As a natural fractal, there will not be an exact replication of the coastline at every level of magnification; however, the proportions will generally remain the same. Similarly, mountains appear jagged from a distance and remain that way as a person comes closer to them. Clouds viewed from the earth appear to have the same texture as they do from a plane. These natural examples of fractals have qualities of self-similarity, even though they do not represent perfect self-similarity.

Today, geographers often use fractals to model nature’s irregular patterns and structures on a computer, and the beauty of fractals only adds to the increasingly expanding field of fractal geography as more scientists utilize these beautiful mathematical formulas to computer model the phenomena of nature.

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## France

**Map Page** 1131 **Area** 212,796 square mi (545,630 square km) **Population** 60,180,529 **Capital** Paris **Highest Point** 15,863 ft (4,807 m) **Lowest Point** -6.6 ft (-2 m) **GDP per capita** \$25,700 **Primary Natural Resources** coal, iron ore, bauxite, zinc, potash, timber.



ONE OF THE DOMINANT nations of Europe since the 9th century, and of the world since the 18th cen-



tury, France is today one of the leaders of the movement toward European unity that will change the balance of the world economy. It is the largest country in western Europe, occupies some of the richest agricultural land, and has a dual orientation—both toward the Atlantic and Mediterranean worlds—that makes it unique among the states of the EUROPEAN UNION (EU).

The French Republic can be divided into Metropolitan France, the historical nation-state in Europe, and its overseas components, known as the DOM/TOMs. The DOMs, or overseas departments, are fully component parts of the republic, and include MARTINIQUE, Guadeloupe, FRENCH GUIANA, and Réunion islands. The TOMs, overseas territories, are not fully incorporated. They include FRENCH POLYNESIA, NEW CALEDONIA, WALLIS AND FUTUNA ISLANDS, and the French Southern and Antarctic Territories. There are also two “territorial collectivities” with special status: Saint-Pierre et Miquelon and Mayotte. These departments and territories are leftovers from the two periods of French colonial expansion: the 18th century in North America and the Caribbean, and the 19th century in Africa. Today, the global French-speaking community, or Francophonie, includes large areas of North and West Africa (ALGERIA, TUNISIA, MALI, and CÔTE D’IVOIRE, for example), and the Canadian province of Quebec. French linguistic and cultural influences remain to a lesser extent in other countries in the MIDDLE EAST (LEBANON and SYRIA) and Southeast Asia (VIETNAM, LAOS, and CAMBODIA).

Metropolitan France is often called “The Hexagon,” due to its roughly six-sided shape: the Atlantic coast, the English Channel, the northern border with BELGIUM, the eastern borders along the RHINE RIVER and the ALPS, the Mediterranean coast, and the PYRENEES MOUNTAINS that divide France from SPAIN. The axis of the hexagon is generally about 600 mi (960 km).

France’s capital, PARIS, is at the center of the northern part of the country, and has dominated French history, culture, and economics since its founding as the royal capital in the 10th century. The population of Paris (about 10.5 million) outnumbers France’s other large cities by 10—one in five French people lives in greater metropolitan Paris—yet regionalism remains strong in many areas: Marseille and Lyon in the southeast vie for the title as France’s second city, while Toulouse and BORDEAUX are rivals for dominance in the southwest. Nantes, Lille, and Strasbourg are regional hubs at the extremities of France’s western, northern, and eastern borders. Nice is also among France’s largest cities, a center for Riviera tourism, but has been



*Mont-Saint-Michel, in the English Channel in northwest France, is accessible by land at low tide and surrounded at high tide.*

part of France’s territory since only the middle of the 19th century.

This late addition of Nice (or Nizza, in Italian) reflects the composite nature of modern France. Known to the ancients as Gaul, named for its Celtic inhabitants, the country takes its modern name from later immigrants, the Germanic Franks, who settled the northern and eastern parts of Gaul after the 4th century, giving their name originally to the area immediately surrounding Paris, today known as the Île-de-France. Other parts of modern France retained their separate identities for centuries: Burgundians in the east, Aquitanians and Gascons (Basques) in the south, Normans and Bretons in the northwest. Loosely unified by the Frankish King Charlemagne and his successors in the 9th and 10th centuries, the French kingdom did not take its familiar modern shape until several centuries

later, with the incorporation of Provence, Burgundy, and Brittany in the 15th century, followed by Flanders and Alsace in the 17th century, and finally Lorraine and Corsica in the 18th century.

Nice and Savoy were the final additions, in 1860. Since the Revolution of 1789, France has become a highly centralized state, and as a result, much of these regionalisms have lost their intensity. The Breton language, for example, has very few native speakers. New mixtures of culture and language are affecting the cultural landscape of France, however, with increasing numbers of immigrants from former French colonies in Southeast Asia and Africa, particularly from North African states such as ALGERIA and MOROCCO.

Today, between 5 and 10 percent of all people living in France are Muslim, affecting the sights and smells of many of France's larger cities, particularly in southern cities like Marseille, where the percentage of Muslims is estimated at nearly 20 percent. At roughly five million, France has the largest Muslim population in Europe. France also has the largest Jewish population in Europe, about 650,000.

Metropolitan France is divided into 96 departments, created during the French Revolution, named for prominent geographical features like rivers or mountains. In 1985, these were regrouped into their older, historic regions, such as Picardie or Aquitaine. Local government continues to exist at both the departmental and regional level, but the regional governments are increasingly pressing for further autonomy from the central government in Paris. Areas with distinct culture are especially interested in greater autonomy, such as Brittany and Alsace, but only Corsica has a significant movement towards outright independence. The 22 regions are as follows:

- Alsace
- Aquitaine
- Auvergne
- Basse-Normandie (Lower Normandy)
- Bourgogne (Burgundy)
- Bretagne (Brittany)
- Centre (consisting of the former provinces of Touraine, Orléanais, and Berry)
- Champagne-Ardenne
- Corse (Corsica)
- Franche-Comté
- Haute-Normandie (Upper Normandy)
- Île-de-France
- Languedoc-Roussillon
- Limousin

- Lorraine
- Midi-Pyrénées (including Toulouse, Armagnac and Foix)
- Nord (the former provinces of Flanders and Artois)
- Pays de la Loire (the former provinces of Anjou and Maine)
- Picardie
- Poitou-Charentes
- Provence-Alpes-Côte d'Azur
- Rhône-Alpes (including Dauphiné, Savoie, and Lyonnais)

Geographically, France can be divided into several regions of highlands divided by broad plains that follow the contours of France's four longest rivers: the Loire, 626 mi (1,010 km); the Seine, 477 mi (770 km); the Garonne, 403 mi (650 km); and the Rhone, 324 mi (522 km) within France. Another major river, the Rhine, forms France's border with GERMANY for 100 mi (161 km). France's plains cover about two-thirds of the total area. Two major basins dominate: the Paris basin in the northwest, drained by the Seine, and the Aquitaine basin in the southwest, drained by the Garonne.

These two rivers are also the main rivers for transportation in France, not the Loire or the Rhone, which are generally too susceptible to flooding and unpredictable currents. Another river, the Adour, drains the basin at the foot of the Pyrenees in France's far southwestern province of Gascony.

Several canals connect France's rivers. The first to be built, the Canal des Deux Mers, was built by Louis XIV in the late 17th century, to connect the Garonne and the MEDITERRANEAN SEA. Today's canal system links all of France's major rivers, and goods can be transported to the Mediterranean from the North Sea via the Meuse, Saône, and Rhone rivers. Some large hydroelectric projects were developed in the 1950s, particularly in the swifter mountain rivers of the south. The most famous of these is the Génissiat dam, on the Rhone above Lyon, which was the second largest in Europe when it was built in 1948.

Today, France is dismantling many of these water projects, in an effort to restore wetlands and natural habitats along its riverbanks. There are few large lakes in France. The largest are formed in low-lying areas along the coast, such as the flat, marshy deltas of the Loire and Rhone rivers. Other parts of the coast vary dramatically, between the chalk cliffs of Normandy, the barren rocky shores of Brittany, and the low-lying



beaches of Languedoc, and the Côte d'Azur, the area of France's famous Riviera. The Riviera encloses the sovereign principality of Monaco, a large percentage of whose residents are French citizens.

France's highest points are along its borders, in the Alps to the southeast and the Pyrenees to the south. The Alpine peak of Mont Blanc, on the border with Italy, is the highest point in Western Europe. Lower peaks are in the Jura and Vosges mountains in the east, plus the Armorican highlands in Brittany. The center of France is dominated by the Massif Central, an ancient weathered PLATEAU with narrow, twisting river valleys. Part of this plateau was once an area of volcanic activity, which left behind the dramatic conic peaks of the Auvergne, such as the Puy de Dôme and the Puy de Sancy. The presence of volcanism is still marked in this area by its mineral water springs, the source of famous bottled water like Volvic. Another area of the plateau further to the east was affected by tectonic activity and the upthrust of the Alps, resulting in the steep ESCARPMENTS of the Cévennes, a region known for its dramatic gorges. The island of Corsica, 115 mi (185 km) to the southeast of the mainland in the Mediterranean, is also mostly mountainous.

The climate in France is mostly continental, with considerable influence from winds and moisture from the Atlantic Ocean. Brittany especially is affected by fogs and rains off the ocean. Higher levels of moisture in the north mean denser vegetation and substantial areas of rich forest land, particularly in the Vosges and Jura mountains, and the valleys of the Aisne and Meuse rivers. The drier south has its share of forests as well, particularly in the flat sandy area of the southwest known as the Landes, which is covered with pine groves. Areas in the southeast have a Mediterranean climate, with seasonal winds blowing across the sea from North Africa, known as the mistral. Higher elevations have a mountain climate, particularly in the southeastern regions of Dauphiné and Savoie. These variations in climate and topography have developed a rich diversity in flora and fauna across the country.

Most of France is still very rural, covered with some of the largest forested and agricultural land in Europe. France produces much of the grains, fruits, and especially wines that are consumed within the EU. In 2003 France produced roughly 20 percent of the total EU agricultural output. France is also a leader in industrial production—machinery, chemicals, automobiles, electronics, and textiles, among others—though France is not as blessed in raw materials as some of its neighbors are. Coal and iron ore were mined for many



*A low-lying beach at Nice, on France's southern coast, has the character of the region's Mediterranean outlook.*

years in the Ardennes region and the Saar basin along the northeast frontier, and they were the source of much of the friction between France and Germany in the 19th and 20th centuries. Franco-German cooperation since the end of World War II has been a cornerstone of the economic integration of Europe, including the introduction of the euro in January 2002. Coal's importance has also largely been replaced because of extensive development of nuclear power.

France is the largest producer of nuclear power in Europe, about half of the EU total, generating 75 percent of France's electricity. Over 1,860 mi (3,000 km) of coastline means that maritime activities have had a central place in the French economy for centuries, but France's tourism industry is today one of the principal contributors to the gross domestic product, catering to over 60 million people a year, the world's most visited

country. Since 1995, France has ranked as the world's fourth strongest economy, with trade surplus continuing to grow, particularly in areas of aerospace, telecommunications, electronics, and software. Companies like Renault and France Télécom have a truly global presence, but French industry is still burdened by an overcentralized bureaucracy. Other products known worldwide include French couture by Dior and Vuitton, fragrances by Chanel and Givenchy, and wines and champagnes from primary areas of French viticulture: Burgundy, Bordeaux, and Champagne.

French history has followed a sequence of tensions and conflicts with its neighbors, first the English, then the Spanish, then the Germans. Political instability has been a norm since the French Revolution overthrew the thousand-year-old Capetian monarchy after 1789. Since then, France has been governed by two restoration monarchies, two empires, five republics, and more than twelve constitutions. Since World War II, however, France has been one of the major engines behind the unification of Europe. The French language continues to be one of the great *lingua francas* of international diplomacy.

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## French Guiana

FRENCH GUIANA, or Guyane française, is the only one of the three Guianas (British, Dutch, and French) to retain its political links with Europe. Having been a full part of the French state as an overseas department since 1946—and thus a part of the EUROPEAN UNION—its citizens look to Europe more than to South America for cultural and economic identity. Indeed, the space center at Kourou, the primary launch site for the European Space Agency since 1964, accounts for about one-fourth of the area's entire income. Though physi-

cally a part of the South American continent, for historical, economical, and cultural reasons, French Guiana, along with its neighbors SURINAME and GUYANA, is generally categorized as part of the Caribbean.

French Guiana is the easternmost of the Guianas; it is also the smallest and the most sparsely settled. Its population of nearly 190,000 cluster along 234 mi (378 km) of coastline or along the country's numerous rivers. The longest of these rivers, the Maroni, forms the western border with Suriname. The rivers emanate from a hilly interior that steadily climbs to the heights of the Tumuc Humac Mountains (the easternmost segment of the Guiana Highlands which stretch from here to VENEZUELA). These mountains, along with the river Oyapock, form the border with the Brazilian province of Amapá to the south and east. Further to the southeast lies the vast DELTA of the AMAZON RIVER, about 250 mi (400 km) away. The coast is highly affected by this proximity, and its swamps and coastal lowlands are continually replenished by organic material swept up the coast from the delta by the Guiana Current. Much of the economy of French Guiana depends on the abundant shrimp found in the river estuaries. The interior is still 90 percent forested and unsettled, and though full of valuable hardwoods and gold, it remains largely unexploited because of unmanageable distances and high costs of transport to the coasts for shipping.

The French were the first to settle in the region, in 1604 (even before they settled in CANADA), but the coastal settlements changed hands with the English and Dutch before settling on the present divisions in the early 19th century. Early settlers grew tobacco and cotton and obtained dyes and woods from the indigenous peoples in the interior (members of the Tupi-Guaraní family). French Guiana was not developed as extensively as its British and Dutch counterparts, due to periodic outbreaks of typhus, malaria, and yellow fever. Its swampy lowlands thus gained a reputation as one of the least healthy climates on Earth and attracted few settlers. Instead, the French government turned the area into one of its major sites for penal colonies, including the notorious Devil's Island, just off the coast from Kourou, which was closed in 1945. The last penal settlement was closed in 1951.

The population, mostly a mixture of French settlers, convicts, and ex-slaves, plus a few Indian and Chinese immigrants brought to work in the 19th century, became French citizens in 1848, was fully represented in the legislature from 1877, and became a full overseas department in 1946. Since 1946, there has been population growth from Hmong refugees from



LAOS, and French continentals who have chosen to retire here. The latter form a strong minority group, whose political party, the National Front, continues to oppose any discussion toward independence, owing to the department's heavy dependence on imports of food and energy from France.

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## French Polynesia

FRENCH POLYNESIA IS a French overseas territory situated in the south central PACIFIC OCEAN. There are five inhabited archipelagos: the Society, Tuamotu, Gambier, Australes, and Marquesas island chains. The islands are volcanic but the Tuamotu chain is made up of low coral atolls of which there are 80. French Polynesia numbers 121 islands in all, 76 of which are inhabited.

The volcanic islands are mountainous and the interior is generally inaccessible. Only the coastline and low hills are inhabited. These high islands are ringed by coral reefs that enclose shallow lagoons. Tahiti is the largest island and covers 402 square mi (1,041 square km). The capital, Papeete, is on Tahiti and approximately two-thirds of the population live on that island. Temperatures range from 77 to 86 degrees F (25 to 30 degrees C), and the climate is tropical and humid with a relatively dry season that runs from April to October and a rainy period from then on, when temperatures generally rise.

The French Polynesian archipelagos were sighted by European explorers in the late 1500s and early 1600s. But Tahiti was officially "discovered" by the British in 1767 and baptized King George's Island. The Marquesas Islands were annexed by the French in 1791 and the rest of Polynesia became a French protectorate in 1842. In 1880, Tahiti became a colony.

The other South Pacific archipelagos were gradually annexed, and together the islands came to be

known as the Etablissements français de l'Océanie. In 1946, the islands became a territory and acquired relative autonomy. In 1957, the Etablissements were renamed French Polynesia.

French Polynesia has its own government with a president and a territorial assembly that has 49 elected members. The Tahitians elect two deputies to the French National Assembly and one senator to the French Senate in Paris.

The president of the French Republic appoints a high commissioner (*haut commissaire*) who is responsible for public order and safety and ensures that civil liberties are properly respected, but he or she does not exercise executive power, which is in the hands of the territorial government. Autonomy was extended by statute in 1977, 1984, and 2004. FRANCE retains jurisdiction in matters such as foreign affairs, currency, defense, public order, civil liberties, and higher education. The Polynesian government has authority in all other areas. The official languages are French and Tahitian (*reo maohi*).

Nuclear testing was carried out in Polynesia on the atolls of Mururoa and Fangataufa in the Tuamotu chain from 1966 to 1996. The economic windfall was instrumental in the territory's development. In 1996, when testing and the related funding came to an end, the French government made important financial commitments in Polynesia to ensure future economic growth and sustainability. The economy is based on the provision of administrative and commercial services, but French Polynesia does have a relatively healthy fishing industry and produces black pearls. The islands are also popular tourist destinations for the French and other Europeans, making tourism an important part of the local economy.

Nevertheless, government subsidies are essential to French Polynesia's economic survival. The islands import far more (mainly from France) than they export (mainly to France), but JAPAN and AUSTRALIA are also important trading partners.

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## French Southern Territories

ONE OF THE MOST remote spots on Earth, the French Southern Territories consists of three groups of islands in the southern INDIAN OCEAN, not too far from the coast of ANTARCTICA, and a thin slice of the Antarctic continent itself, known as Adélie Land. No one lives permanently in these territories, but they are seasonally visited by teams of naturalists and other scientists.

The territory is officially known as the *Terres australes et antarctiques françaises* (TAAF) and has been an overseas territory of France since 1955 (previously administered as a dependency of the Madagascar colony). The island groups consist of two archipelagos, Crozet Islands and Kerguelen Islands, and two volcanic islands, Amsterdam and Saint-Paul.

Kerguelen is formed of about 300 small islands, with a total area of about 2,700 square mi (7,000 square km). The Crozet Islands are smaller in area, with 5 large and 15 smaller islands. Amsterdam covers an area of 23 square mi (60 square km), while nearby Saint-Paul is only about 2.7 square mi (7 square km). All of the islands are volcanic in origin. Adélie Land lies between 136 and 143 degrees E longitude south of the Antarctic Circle and encompasses about 150,000 square mi (389,000 square km), forming a wedge from the South Pole to the sea. The Antarctic Treaty of 1959 declares all of Antarctica to be a neutral zone, but France retains some claims to Adélie Land and maintains a manned research station at Base Dumont d'Urville.

The Kerguelen Islands are located approximately 3,300 mi (5,300 km) southeast of South Africa. The largest island in this archipelago is called Kerguelen, or Desolation Island, mountainous and mostly barren. Its coastlines are heavily indented by deep inlets and fjords. The Kerguelens lie atop the submarine Kerguelen-Gaussberg Ridge, which accounts for the islands' volcanism. Its peaks are volcanoes but are almost entirely covered by glaciers and permanent ice. The climate is among the harshest on the planet, with rain, sleet, or snow almost every day and nearly continuous wind, averaging 68 mi per hour (110 km per hour) year-round, sometimes gusting up to 123 mi per hour (200 km per hour). Kerguelen lies at the Antarctic Convergence, where upwelling cold water from the south mixes with the warmer waters of the Indian Ocean, creating a natural feeding and breeding ground for birds and marine mammals.

Like Kerguelen, the Crozet Islands form the above-water portion of a submarine volcanic plateau, divided

into two groups of islands—l'occidental (western) and l'oriental (eastern)—separated by about 60 mi (100 km). The eastern group includes the largest island, Île de la Possession, on which is located the only permanent scientific camp, Alfred-Faure, set up in 1961. There are no natural ports or airstrips. Since 1938, the Crozets have been a national park. The beaches are black volcanic sand, washed down from the islands' volcanic peaks, the highest being Pic Marion-Dufresne (3,576 ft or 1,090 m). Unlike Kerguelen, these peaks are not covered in ice.

The islands of Amsterdam and Saint-Paul are the most northerly of the group and are thus devoid of snow and ice, even in winter. Amsterdam is surrounded by abrupt cliffs, and is the site of a permanent base, Martin de Viviès, where about 20 scientists winter each year. Saint-Paul is characterized by a spectacular central caldera that has been invaded by the sea, delimited by two natural rock jetties. These islands, of very recent formation in geologic terms (within the last 700,000 years), are astride a volcanic hotspot over the spreading Southeast Indian Ridge. The islands' greater heights (2,907 ft or 881 m maximum) reflect this youthful geologic age, though no volcanic activity has been recorded since the 19th century.

All of the islands of the French Southern Territories have large populations of penguin, albatross, and seals. Early-20th-century introductions of rats, cats, rabbits, pigs and goats have now mostly been eradicated but left their mark on this fragile ECOSYSTEM. France declared the largest Exclusive Economic Zone (EEZ) in the world around the Crozets, Kerguelen, and Amsterdam-Saint-Paul in 1978 to stop overfishing (principally of the Patagonian toothfish). This EEZ is patrolled by the French navy and Greenpeace.

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## frontier

AS WITH SO MANY geographic terms, the concept of frontiers is closely linked with other ideas. In practice, frontiers rarely remain the same; changing with time

and technology, and in the process adjusting the world they have affect upon. It has become common to view frontiers in reference to some political or geographical area that lies beyond the more integrated core of a region and into which expansion could take place. Historically, our image of a frontier often reflected a belief that such places were hostile, empty environments and beyond the reach of settlement. But in a more modern sense, it is more accurate to consider it as peripheral to the primary area of settlement and thus still part of the region as a whole. If we start with this basic idea, we see that frontiers have location, area, boundaries, and some hierarchy. We must also recognize that frontiers can be classified by type, typically political or physical, but they can also be considered as conceptual.

Political frontiers tend to be artificial in the sense that they represent expressions of territoriality on the part of sovereign states as they define their boundaries. They are zones of varying width that refer either to the political division between two countries (or political groups) or to the settled and uninhabited parts of a country. As such, they are part of political geography. Such political boundaries come about for several reasons, but usually we think of them as one of five types: pioneer, antecedent, subsequent, superimposed, and relic.

There are also natural frontiers, physical features that stand out as natural boundaries between places. For millennia, a system of natural frontiers served as the basis for dividing all types of space. This was particularly so for regions, states, and nations, which often pretended that geography was the sole determinant of the limits of states, and that mountains and rivers were limits established by nature to determine the question of property between nations. Curiously, there never has been even one single nation that by virtue of the system of natural frontiers has dreamt of restricting its possessions and the limits of its control.

It must be said that natural features (and natural defenses) such as seas, mountains, and rivers can serve very different purposes. There are times when the sea separates nations, and there are times when it unites them. The great Greek historian Horace once called the ocean the great divider of nations. But it is just as easy to see it from the opposite perspective, as the bond of the world. This highlights the fact that over time, barriers perceived to be inaccessible may have a technological basis to their service as a natural barrier. A simple drive is all that is necessary today to cross great mountain ranges or board a plane in Denver and two hours later land in San Diego. In each case we must ask our-

selves where exactly are the natural frontiers? It is the same story for rivers. The rivers running under bridges are no longer seen as separating nations as they were considered in the days of great city-states. Quite the contrary, they unite them, and instead of being obstacles to overcome they are now viewed as community bonds.

Natural frontiers made perfect sense when all forms of transportation were limited to muscle power and the world was a system of land-based nations. But once you add sources other than muscle power to transportation, the usefulness of natural boundaries as markers for the extent of a nation's frontier comes quickly into question. Major changes in technology have usually resulted in major changes in transportation geography. As you redefine space in terms of time, you also redefine it in terms of distance. If you have ever used the phrase "it's a small world" you know that which was far away even 100 years ago, is right next door today.

A frontier today is the opposition and the contrast of peoples. It is not the PYRENEES, which separates FRANCE from SPAIN, as much as it is the difference in manners, habits, and customs between the two areas. Ideas such as this help clarify the fact that conceptual frontiers reflecting the wants and needs of people play an active role in determining how we view both political and physical frontiers. This does not mean that frontiers no longer exist, for they clearly do. But the scale at which we define them has changed on all levels, as well as has our purpose in determining what frontiers are. Things considered to be science fiction by Jules Verne have become reality.

Politically, we have passed from that which was considered empire to kings and emperors to that which is the empire for multinational corporations. Now boundaries in time and space are reflected as inefficiencies in the market; as costs that hinder the degree to which nations develop.

In many respects, the wish to fix boundaries is out of date. In a century where we talk of colonizing other planets and lay plans for ventures to Mars, it is the will of nations that determines frontiers, not nature. Nations make their frontiers; nations themselves create the barriers that exist between themselves and their neighbors. It is also out of this dominance of the land that a new global perspective has grown, for as the power to dominate nature and eliminate frontiers has expanded, so has the understanding that it has not been done without tremendous environmental cost. This unity of environmental consciousness extends far

beyond the traditional politico-geographic realm, where coalitions of states now discuss the consequences of global action.

The rapid elimination of space as the ultimate barrier has given territory and frontiers new meaning. In an increasingly global world economy, frontier lands whose sparse populations once served as ideal buffers against outside invasion must now be made part of the whole. Today, the entire geopolitical model as laid out by Halford J. MACKINDER has been inverted. Now, instead of providing some type of insular space as a means of preserving a nation's status, frontier space is a threat to national unity if not made a convincing and functional part of the national consciousness.

For regions to remain sustainable, they must have some coherent principle, some organizing factor, focal point, or purpose. This relationship has typically taken the form of the core-periphery model, with a central community or economic driving force defining the core and a less well-defined zone or zones of dependency arrayed around the core. As regions mature, frontier areas pass into the domesticated landscape. New communities must now be founded in locations other than those defined by ideal topography. Two hundred years ago, frontiers were seen as vital to stability in the geopolitical world. Today, frontiers are viewed as the biggest obstacles.

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## Fulda Gap

LOCATED IN GERMANY, between the cities of Leipzig and Frankfurt, and oriented along the Fulda River, the Fulda Gap is a name given to a mobility corridor oriented on a line that runs from Leipzig toward Frankfurt. It is bounded on the south by the Vogelsberg Hills

and on the north by high ground north of the autobahn (highway) that transects this area. Early in the beginning of the Cold War (1947–89) NORTH AMERICAN TREATY ORGANIZATION (NATO) war planners developed contingency plans for the defense of Western Europe in the event of a Soviet Union-led invasion. They considered the Soviet ground combat doctrine, the mechanized and motorized nature of modern forces, and the compartmentalized terrain of both West and East Germany (Federal Republic of Germany and the German Democratic Republic). Military planners considered the most likely avenue of approach for the main thrust of an invasion would be down a mobility corridor along a general line from Leipzig to Frankfurt and the RHINE RIVER. The hub of this corridor begins in the vicinity of the towns Erfurt and Eisenach and crosses the old border between East and West Germany in the Phillipstal-Rasdorf area. The route would cross the Fulda River and then run west to the gap between the Vogelsberg Hills and the high ground north of the autobahn. The broader corridor that begins at this gap and runs astride the autobahn all the way to Frankfurt and the Rhine was known by U.S. forces charged to defend this area as the Wetterau Corridor.

The first defensible terrain on the western side of the inter-German border was the Fulda River, which would have to be crossed by any invading force. The mobility corridor remains somewhat restricted by the high grounds to the north and south. Once past this gap, the terrain opens up allowing for greater maneuvering, and would give an invading force more opportunity to invade Frankfurt and seize crossing points along the Rhine River.

The European General Defense Plan called for U.S. forces to deploy along a general defense line that could interdict Soviet forces moving into West Germany along routes through geographic areas such as the Fulda Gap. These operations plans described in detail how the U.S. forces would respond to a Soviet-led attack across the inter-German border. The concept was to delay invading forces long enough for reinforcements to arrive from the UNITED STATES. The plans described the defensive positions and actions of each unit and even laid out the nightmare scenario of use of nuclear weapons by ground forces.

The U.S. Army was most familiar with this invasion route, as General George S. Patton's Third Army had come through the Fulda Gap in its drive from the crossing of the Rhine near Frankfurt to Leipzig in April 1945. Armies have passed in both directions along this corridor in many wars, including the Austro-Prussian



War (1866), Napoleonic Wars (1806), Seven Years' War (1756–63), and Thirty Years War (1618–48). It appears that even the marauding Mongols and the imperial Romans used this route for travel and conquest.

With the break up of the Soviet Union and the reunification of Germany, the Fulda Gap has returned to the archives as a military planning concern. As former U.S. Secretary of State Colin Powell said, "I was defending the Fulda Gap as a young lieutenant. Now it is a tourist attraction."

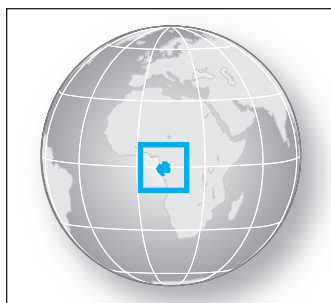
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## Gabon

**Map Page** 1115 **Area** 103,347 square mi (267,669 square km) **Population** 1,234,000 **Capital** Libreville **Highest Point** 3,215 ft (980 m) **Lowest Point** 0 m **GDP per capita** \$5,500 **Primary Natural Resources** cocoa, coffee, timber, minerals (gold).



LOCATED ON THE ATLANTIC OCEAN coast in Central Africa, Gabon shares borders with CAMEROON, Republic of the CONGO, and EQUATORIAL GUINEA. Gabon is a unique contrast to what one might think of in a country straddling the equator. Most of the landscape reflects the influence of Gabon's major river, the Ogooue, West Africa's major river between the CONGO and the NIGER rivers. The Ogooue basin dominates the eastern two-thirds of the country. There are two other lesser regions within the Gabon landscape, the Woleu-Ntem River basin in the north and an interesting coastal plain in the west and southwest.

Approaching the country from the sea, one of the distinctive features first noticed is the extensive parkland that appears in the hills just beyond the coast. Rather than mangrove swamps, many places have



broad open grasslands on terraces beyond the coast that are intermixed with larger old growth trees. Beyond the parkland, the land rises in a long arc of highlands that run roughly parallel to the coast and that separate the upper Ogooue basin in the interior from the ATLANTIC OCEAN.

There are also a number of lakes on the coastal plain below Lambarene that collect water for the lower Ogooue River before it empties into the Atlantic. The southern coastal plain is actually an extension of the sand beaches running north from the mouth of the Congo. The northern portion of the coastal plain is separated from the upper Ogooue region by a series of plateaus ranging from 1,000 to 2,000 ft (300 to 600 m) above sea level.

### HIGHLANDS AND PLATEAUS

Between the two coastal plains is the country's major highland region, the Chaillu Massif that rises to an elevation of 3,215 ft (980 m) at Mount Iboundji, Gabon's highest point. In the north, the plateau lands, which reach some 2,500 ft (760 m), begin to merge as one moves to the northeast, until they join the Cristal Mountains. In the southeast is the hot and arid Bateke Plateau at 2,700 ft (820 m).

Gabon has a typical equatorial climate. Rainfall is heavy and varies by location and time of year. The annual average is almost 120 in (305 cm) at Libreville,

the capital, to 150 in (381 cm) on the northwest coast. Most of the rain comes between October and May. Temperatures show little seasonal variation, averaging about 81 degrees F (27 degrees C) each month of the year. Surprisingly, it does not feel as hot as one might expect for a country astride the equator, and nighttime lows are often near 60 degrees F (16 degrees C) in the highlands.

About three-fourths of the country is covered by dense equatorial rainforest. Within this rich ecological zone grows the Gabon mahogany, a hardwood tree that forms the backbone of Gabon's wood industry. The dense forest vegetation supports a wide assortment of animals including gorillas and elephants. Gabon does not have many mineral resources, but those that it has are important. There are large reserves of manganese and significant deposits of high-grade iron ore in the interior. There are also commercial quantities of uranium. Offshore, there are deposits of petroleum and natural gas.

Finally, while Gabon is a rich country by African standards, many Gabonese are not sharing in the wealth. The disparity in the quality of life is encouraging rapid migration from rural to urban areas.

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## Gaia

THE IDEA THAT nature is a holistic unity has been constantly existent throughout human history. The major reemergence of the idea took place in the early 20th century in the name of holism. This reappearance of holism became the foundation of the Gaia hypothesis, the most recent recurrence of the ancient belief of the harmonious interconnectedness among natural phenomena on the Earth. Originally stated by the English atmospheric scientist James Lovelock in the 1970s, this hypothesis and related arguments dominated the academy in the second half of the 20th century. Lovelock insisted on the existence of a single planetary ECOSYSTEM in the universe, Gaia.

Gaia includes all organisms: flora, fauna, and their surroundings, such as the land, waters, and atmosphere. Moreover, Gaia functions as a single organism, a self-regulating system that is capable of controlling deviations in climate, correcting chemical imbalances, and recovering from any other environmental damage. According to this hypothesis, the Earth is a living organism. Humans, of course, are part of Gaia, and if we become too harmful to our habitat, the system will automatically act to bring us to extinction. The microbiologist Lynn Margulis supported this hypothesis, and the novelist William Golding endowed the name, Gaia, upon it. This concept is named after the ancient Greek Earth-Mother goddess in respect to her dual characteristics: a maternal figure to nurture beings who adapt to the environment and, in contrast, a harsh destroyer of lives who do not obey her governance. This goddess figure is a metaphor of a process that we call natural selection.

Using the study of ancient myth and spiritual traditions of Plato, Johannes Kepler, and Johann Wolfgang von Goethe regarding the Earth's origin, the nurturing power of Mother Earth is revealed in the general beliefs that the Earth is a self-regulatory organic whole and that humans need to adapt to the ecosystem for survival. Gaia became a very popular idea in environmental determinism, the belief that the physical environment is the dominant force in shaping cultures and that humankind is essentially a passive product of its physical surroundings. This idea eventually developed into ethical issues of stewardship, trusteeship, and importance of sustainable living. In the Gaia hypothesis, humans are not the owners, tenants, or even the passengers of this superorganism. We are simply surviving our species' "allotted span," as Lovelock put it.

The Gaia hypothesis has emerged as the ideas of several cultures from antiquity, but there were no scientific predecessors to prove the accuracy of the theories. Today, Gaia hypothesis is also used among nonscientists to refer to theories of the Earth as a self-regulating organism that inspires humanistic perspectives as well. Some scientists viewed the concept of Gaia difficult to accept as a scientific theory about Earth, and Lovelock's initial hypothesis encountered much antagonism in this respect.

Although Gaia as a concrete concept has its origin in scientific background, it provides a fitting framework to bridge the gap between PHYSICAL and HUMAN GEOGRAPHY as a whole. The core of environmentalism seeks reconciliation of binary divisions, and the concept of Gaia serves as an example of this current in



contemporary geography. However, today, the Gaia hypothesis is well accepted in the studies of the Earth, including geography, and no controversy exists. Therefore, Gaia is the origin of the idea we gained that life and the environment enjoy a two-way relationship.

### THE EARTH AS AN ORGANISM

The idea of a living Earth—the Earth as an organism—is not new but is quite ancient. With the metaphorical association of Gaia with the goddess and Earth Mother, we have lost this understanding only since the advent of objective science that clearly separated the domains of nature and culture. There were some predecessors who advocated the idea of a living Earth even in the scientific period. James Hutton, the Scottish father of geology, was aware of the Earth as a kind of superorganism. Jean-Baptiste Lamarck, French biologist and botanist, proposed a theory of biological evolution with awareness of the all-encompassing power of the Earth.

Goethe suggested that the planet was an organism of the world soul that permeates and gives teleology to the dynamics and metamorphosis of the overall matter. His idea that life on planet Earth is not just a layer over the lifeless ground but makes a dynamic living whole with the planet (as a global organism) influenced the making of the Gaia hypothesis. Alexander von Humboldt, the father of ecology, was the first to take on the study of the relationship between organisms and their environment. And the Russian scientist Vladimir Vernadsky introduced the concept of the BIOSPHERE. He recognized life as “a geological force” and the atmosphere as an extension of life. As a synthesis of these ideas, much truth exists in the Gaia hypothesis.

The idea of Gaia is based on an environmental perception of nature that varies from one culture to another. We must understand that nature itself is a culturally formulated concept that has different meanings to different peoples. There are two major subsets in viewing nature: organic and mechanistic. In the organic view, held by many traditional groups, people are part of nature. Every habitat possesses a soul and is filled with organisms and thus requires respectful treatment.

On the other hand, most Western peoples tend to recognize the mechanistic view of nature. In this perspective, humans are separate from and hold dominion over nature. Along this line, the environment became an integrated system of mechanisms controlled by external forces according to natural laws and understood by the human mind. The Gaia hypothesis is praised for

its questioning the dominant mechanistic view of humans that justifies ultimate human control over nature.

The Gaia hypothesis has a close association with ecofeminism as a part of ecotheology. Although the Judeo-Christian tradition elevated a sky-god to a remote place from the Earth, the harmonious relationships between people and the habitat, sky and the Earth, and male and female should not be disrupted. Emergence of teleology was not avoidable as a result of the disappearance of the Corn Mothers and all other female deities. Thus, the Gaia hypothesis subscribes to this spirit of ecofeminism by revisiting an ancient holiness of ecosystem as a whole.

### BIRTH OF THE GAIA HYPOTHESIS

In the early 1960s, Lovelock collaborated with the National Aeronautics and Space Administration (NASA) to investigate evidence of life on Mars. In an effort to design instruments to detect the presence of life on Mars, the environmental differences between the Earth and Mars led Lovelock to think about what constitutes life, and how it can be detected under varied circumstances. Lovelock hypothesized that the most general characteristic of life was that it takes in energy and discards waste products in return. He also assumed that living organisms would conduct cyclical exchange by using the planet's atmosphere, as organisms on the Earth breathe in oxygen and expel carbon dioxide. According to this hypothesis, life on Mars would also leave a substantial chemical signature on the atmosphere. It could probably be detected from the Earth, so Lovelock thought that it would not even be necessary to send a spaceship. This Mars question inspired Lovelock to concentrate on the Earth and the nature of its atmosphere.

Observing the Earth from a Martian perspective, Lovelock looked back at the historical interaction between Earth organisms and the atmosphere. He noted that bacteria and photosynthetic algae started to remove carbon dioxide from the atmosphere, producing oxygen as a waste product about 3 billion years ago. Over the course of time, this process changed the chemical content of the atmosphere to the level of oxygen poisoning, which was relieved with the advent of organisms powered by aerobic consumption. The atmosphere is supported by the process of cumulative actions of numerous organisms. The holistic effect of these processes was that the Earth itself appeared as a living entity within the universe. Lovelock suggested that the Earth could best be characterized as a superorganism—this is the birth of today's Gaia hypothesis,

which recognizes the Earth as a self-regulating organism. There are at least two versions of the Gaia hypothesis: weak Gaia and strong Gaia. Weak Gaia is the assertion that the Earth's climate and surface environment are actively regulated by animals, plants, and microorganisms. Strong Gaia is the unashamedly teleological idea that the Earth is a superorganism that controls the terrestrial environment to suit its own ends, whatever they might be. On this, all humans and other organisms are mere icing on the Earth. Lovelock seems to favor strong Gaia. He believes that it is useful to regard the Earth not as an inanimate globe of rock, liquid, and gas driven by geological processes, but as a biological superorganism, a single lifeform, a living planetary body that adjusts and regulates the conditions in its surroundings to suit its needs.

### GAIA AND HUMANISM

According to Lovelock, the Earth behaves as if it were a superorganism, which is composed of all the living entities and of their material environment. When he first came up with his Gaia hypothesis, this new idea caused disputes among scholars as much as it impressed people around the world. Gaia has even grown out of scientific research into the realm of humanism in a short period of time. The Gaian perspective of the Earth provides the parameters for species survival by focusing on powerful resilience against any forms of disturbance. There are no special roles assigned to humans in the concept of Gaia.

The thesis is an Earth-centered perspective, and humans have to find their place to adjust within the natural order set by the Earth. Humans must respond in collectivity to unwritten laws of Mother Earth, recognizing themselves as a tiny piece of a puzzle to compose the Earth.

This understanding also delineates several concepts such as deep ecology and transpersonal philosophy. The Earth started out as a self-regulating organism, and humans were supposed to adapt to their environment. After several millennia, however, this power relationship has been transformed in many ways—this is why it is important to consider the interaction between Gaia and humanism today. There are new dimensions to the Gaia hypothesis as humans increase their impact on the Earth. Humanization of the Earth is continuing throughout history, and this fact offers a variety of case studies of our places on the Earth.

Today, with the rise of technology, humans began to obtain more dominant roles within the Gaian circle, shaping the cultural and physical landscapes and im-

pacting habitat through the exploitation of resources. Keeping balance with other organisms, each cultural group has developed its own ways to understand nature and how humans should relate to it.

Western scientists describe Gaia as a large and systematic integration of biophysical and economic phenomena. However, in a simpler and truer term, the reality for most humans is a mosaic of culture-bound worlds, each seeking to negotiate values of social and ecological integrity into eventual global integration. New research possibilities have been opened by this discourse. Gaia hypothesis certainly inspires us to rethink and redirect this scientific society, and reflecting upon the mythological, religious, and aesthetic origins it contains is of vital importance today. It is not a mere nostalgia toward ancient ideals, but exploring Gaia means recognizing the potential to help the world from the ecological crisis we, human beings, have brought on by ourselves.

### CRITICISMS

Lovelock recalled the cold neglect from the professionals to the Gaia hypothesis that lasted until the late 1970s. Then the Gaia hypothesis began to be highly criticized in the late 1970s by many scientists for being teleological, indicating that the hypothesis is based on a belief that all things have a predetermined purpose. Teleology in a Christian sense often emphasizes the embodiment of God's plan on the Earth. Lovelock experienced severe difficulties with many scientists who considered the theory teleological in that it required foresight and planning by biota.

It is in this venue that the Gaia hypothesis inevitably raises the issues of teleology that were revealed by criticisms from scientists: Whether nonhuman beings, such as ecosystems or evolutionary processes, can have a specific "purpose." Lovelock states that his Gaia theory demands responsiveness in the systems, but it does not include awareness, foresight, or intention. The response of organisms is always automatic, and natural selection divides the fate of those that are fitted or not for the conditions. The Gaia hypothesis was very critically received, in particular by the molecular biologists Richard Dawkins and Ford Doolittle. They argued that organisms in this theory would require foresight and planning and could not act in concertation. Scientists Dawkins and Doolittle denied the possibilities of the evolving feedback loops that stabilize the Gaian system.

They argue that as Gaia cannot reproduce itself, it cannot be alive. Gaia was also objected by the clima-

tologist Stephen Schneider and the geochemist H.D. Holland. They also claim that the theory is not scientific enough because it is impossible to test it by controlled experiment. In 1988, Schneider organized a Gaia conference, a meeting of the American Geophysical Union solely to discuss Gaia and its plausibility. This conference terminated teleologism associated with the Gaia hypothesis. Lovelock presented a new version of the Gaia hypothesis from which he abandoned any attempt to argue that Gaia intentionally or consciously maintained the complex balance in its environment that life needed to survive. This new hypothesis was more acceptable for the scientific community. Lovelock supported his new hypothesis with the metaphor of Daisyworld.

Using computer simulations of the Daisyworld parameters and a mathematical approach with evidence, Lovelock proved that the controlled stability of the climate by life and the idea that the Earth as a self-regulatory organism should not be referred to as teleological. The new Gaia hypothesis stated that Gaia was homeostatic, that is, that the biota influence the abiotic world in a way that involves homeostatic feedback, and it convinced Lovelock's contemporaries. During the Gaia conference, James Kirchner, a physicist and philosopher, suggested that there is not one Gaia hypothesis, but several hypotheses. He then described five of these: Influential Gaia, Coevolutionary Gaia, Homeostatic Gaia, Teleological Gaia, and Optimizing Gaia. After initial criticism, the Gaia hypothesis is now considered an essential part of ecological science, proposing the planet as an organism to be the object of both ecological and humanistic studies. Today, most ecologists are confident to characterize the biosphere as a superorganism and consider this hypothesis as relying on the concepts of biosphere and biodiversity. After experiencing the series of struggles, the Gaia hypothesis is a fully recognized entity in ecology in this century.

### GAIAN FUNDAMENTAL ETHICS

In Lovelock's view, humans as one group of organisms are peripheral yet dangerous, along with the technological evolution to the life systems of the planet. Our fundamental human-centered concern is to preserve the Earth as we want it. Lovelock believes that ideas of stewardship of the planet are the reflection of our arrogance. The large plants and animals are synonymous with the icing on the cake; the basis of life—what matters for a living planet—is microbiological matters, over which humans have no control. This raises major questions about responsible behavior and living of in-

dividual humans and social groups. Gaian thinking suggests an alternative to the human-centered view that the world is mechanistic and that everything can be reduced into "parts," which associates life with the laws of physics and chemistry. The new view emphasizes the interconnectedness of the living world as a unitary organism.

According to this perspective, this world is not the world of machine, but the world of organism. Thus, this understanding enhances our awareness that we cannot treat nature as a machine and immerse ourselves in the world as participants. In this way, the Gaian worldview can influence the making of our ethics that bridge humans, ecosystems, and the planet. The Gaian view may make it possible for humans to see themselves as significant (because we are conscious and self-reflexive) parts of a symphonic interaction, which becomes the meeting ground of this scientific theory and humanistic studies. An understanding of Gaia could even become the focus for religious studies, thus influencing a change in human impact on the planetary process. Lovelock explains that Gaia means a religious as well as a scientific concept, and in both spheres it is manageable. Therefore, God and Gaia, theology and science, even physics, biology, and humanities, are not separate, but they create a unitary way of looking at the world.

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## gallery (galeria) forests

GALLERY FORESTS are commonly defined as any forest along a river or stream, especially in a grassland. Since geographers frequently cite BRAZIL as the best example of this phenomenon, we often use the Portuguese word *galeria* to identify it. Gallery forests are also found in places other than Brazil. For example, an article in the journal *Landscape Ecology*, discussing gallery forest expansion in KANSAS, quotes the Spanish explorer Francisco Coronado as saying in 1541, "There is not any kind of wood in all these plains, away from the gullies and rivers, which are very few." Gallery forests are common in tropical Africa, too.

Brazil's Amazon basin is covered mostly by tropical RAINFOREST. To the south, many tributaries of the AMAZON RIVER flow northward through tropical savanna GRASSLANDS. Detailed vegetation maps of Brazil show fingerlike extensions of tropical rainforest protruding from the Amazon along the banks of these tributary rivers. These protrusions are called gallery forests. On smaller streams, the crowns of gallery forest trees interlock above the stream. If you were to float down such a stream, you would travel through a long green tunnel or gallery of vegetation.

Tropical rainforests typically exhibit tremendous biological diversity. A small patch may contain many species of trees. These trees are tall and form a leafy canopy 100 ft (30 m) or more above the ground. This canopy prevents much sunlight from reaching the forest floor, which generally has limited amounts of undergrowth. Wherever sunlight does reach the forest floor, however, a profusion of bushy plants known as jungle vegetation is the result. One place where this occurs is along the banks of large rivers. Tropical gallery forests, therefore, contain plenty of jungle vegetation.

Many of the animals that make the gallery forest their home live in the canopy. Arboreal animals are well adapted to life in the trees. South American monkeys, for example, have prehensile tails to help them grasp tree limbs. Birds seek foods such as the seeds in fruits or tree-dwelling insects.

Most trees in Brazil's gallery forests share some common traits. They are mostly hygrophytic (water-loving), well suited to an environment that undergoes prolonged flooding each year. Most are dense hardwoods such as mahogany and teak, prized by lumber merchants for such uses as flooring, cabinetmaking, boatbuilding and interior trim. Exploiting this resource is a challenge, however. First, the trees do not occur in pure stands. Second, once found and cut down, they

are difficult to transport to the sawmill. Because the wood is so dense, the logs will not float. Despite these difficulties, loggers feel that the effort is worthwhile, since a single tree may fetch several thousand dollars.

Loggers are taking even the less desirable trees, converting the wood into charcoal for use in one of Brazil's iron smelters. Gold mining and other mining activities complicate the picture. Not only do mines scar the surface of the Earth, the mercury that the miners use to process the gold pollutes the rivers. Fish take up the poisonous mercury, making them unfit for human consumption.

### CONTROVERSIAL POLICIES

Controversies have developed concerning the best policies for the Brazilian government to implement with respect to the Native Americans living in the forests. Many of these indigenous people, though migratory, prefer to live in villages along the banks of rivers, where they can maximize protein intake through fishing and hunting. Such a location exposes them to exploitation and harm by outsiders. Although the government has implemented safeguards for the natives, federal agencies have limited resources for enforcement. So the natives are faced with a dilemma: retreat deep into the rainforest, where resources may be more scarce, or stay where they are and suffer the possible negative consequences.

Geographic scientists are dismayed to see the steady destruction of Brazil's rainforests and gallery forests. They point to such problems as the disappearance of plants that may have medicinal value, the shrinkage of habitat for animals, the climatic consequences in terms of accelerated global warming and decreased rainfall, soil erosion, and possible job losses because sustainable economic development may no longer be possible. Estimates made from study of the latest satellite images suggest that Brazil's forests may disappear well before the end of the twenty-first century, much sooner than originally predicted.

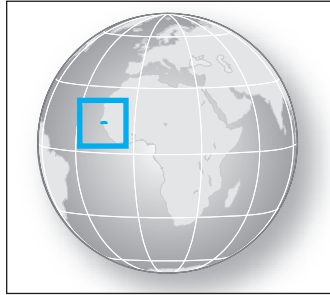
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## Gambia

**Map Page** 1113 **Area** 4,361 square mi (11,300 square km) **Population** 1.36 million **Capital** Banjul **Highest Point** 174 ft (53 m) **Lowest Point** 0 m, **GDP per capita** \$1,700 **Primary Natural Resources** peanuts, millet, sorghum, corn, sesame, cassava.



GAMBIA IS BORDERED by the ATLANTIC OCEAN on the west and surrounded on the remaining three sides by SENEGAL. The smallest country on the continent of Africa, Gambia is composed of a narrow strip never more than 30 mi (48 km) wide. This narrow strip of land borders the banks of the Gambia River for 200 mi (320 km) above its mouth. The river, whose source is in GUINEA and which flows 600 mi (970 km) to the Atlantic, is navigable throughout Gambia and is the main transport artery.

Sand beaches line Gambia's coast, while inland lie swampy river valleys whose fertile alluvial soils support rice cultivation. On higher lands are cultivated peanuts—the country's chief cash crop—and some grains. The climate is warm and fairly dry.

A large number of ethnic groups live in Gambia with a minimum of intertribal friction. The Malinke (Mandinka) is the largest, followed by the Fulani (Fula), Wolof, Diola (Jola), and Soninke (Serahuli). Approximately 3,500 non-Africans live in Gambia, including Europeans and families of Lebanese origin. More than 95 percent of the population is Muslim, while Christians of different denominations account for most of the remainder. English is the official language, but a number of African dialects are spoken in the country.

During the late 17th century and throughout the 18th, FRANCE and England fought continuously for political and commercial supremacy in the regions of the Gambia and Senegal rivers. Great Britain was given control of Gambia by the 1783 Treaty of Versailles. Gambia achieved independence on February 18, 1965, as a constitutional monarchy within the British Commonwealth.

On April 24, 1970, Gambia became a republic following a referendum. Until a military coup in July 1994, Gambia was led by President Sir Dawda Kairaba Jawara, who was reelected five times. In November 1996, the retired Colonel Yahya Jammeh became pres-

ident of the Republic of The Gambia. He was reelected in 2001.

Despite attempts at diversification, Gambia's economy remains overwhelmingly dependent on the export of agricultural products, of which peanut products form the bulk. Other exports include dried and smoked fish, cotton lint, palm kernels, and hides and skins. About three-quarters of the population is employed in agriculture, which accounts for 33 percent of the gross domestic product. Millet, sorghum, rice, corn, cassava, and beans are grown for subsistence. The main industrial activities lie in the processing of agricultural products. The EUROPEAN UNION, CHINA, JAPAN, and Senegal are the country's leading trading partners. Gambia is one of the poorest nations in the world and heavily dependent upon foreign aid.

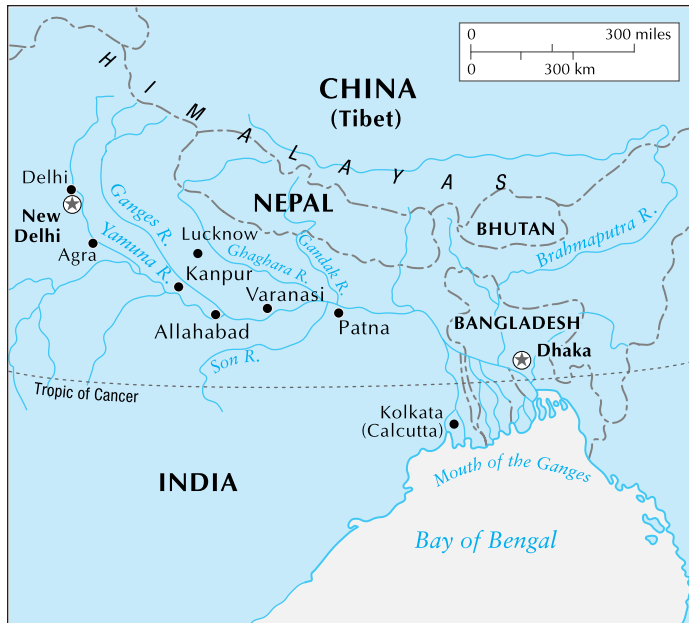
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## Ganges River

ORIGINATING IN TIBET and flowing 1,557 mi (2,507 km) from northwest to southeast through INDIA, the Ganges River empties into the BAY OF BENGAL. Known as the Ganga in India, it is the most important river in South Asia, sustaining the lives of literally hundreds of millions of people daily. Along with its sister river the INDUS, the two create the broad and densely populated Indo-Gangetic Plain that stretches in a great arc from the ARABIAN SEA, along the Himalayan foothills to the Bay of Bengal. The divide between the two great river complexes is a mere 300 ft (91 m) in elevation.

The early civilizations that were born on the banks of the Indus moved easily across to the waters and fertile lands of the Ganges. The great literary traditions of oral hymns of the Vedas tell of the conquest and settlement of the Ganges by Aryan-speaking migrants. The



*The Ganges is the most important river in South Asia, sustaining the lives of literally hundreds of millions of people daily.*

Ganges has always been a primal and spiritual force to the millions who have lived along its banks across the millennia of history. Still today, the Ganges is the holiest of rivers in the Hindu tradition, and the faithful flock to it for spiritual cleansing and healing.

The Ganges is a goddess, Ganga devi, one of the two daughters of Meru (the HIMALAYAS). The river is honored in the ancient Vedas and in the two great epic poems, the *Ramayana* and the *Mahabharata*. Even the Lord Vishnu bathed in these holy waters that wash away all sins. Great annual festivals bring massive crowds to sacred sites along the Ganges and especially during the *Melas* that occur every few years on auspicious dates. The waters of the river are considered immaculate, and any amount can purify people, places, and objects.

The Ganges River basin covers almost 25 percent of India's area. The Himalayas bound it to the north and the Vindhya Range in the south. The Ganges has its source from the huge and ancient glaciers of the Himalayas. Fittingly, the three great rivers of South Asia, the Indus, the Brahmaputra, and the Ganges all have their source fairly close together in the Himalayan foothills. The Indus winds down into KASHMIR and on through the Punjab and Sind to the Arabian Sea. The Brahmaputra journeys to the north on a long journey in Tibet only to join the Ganges far downstream in BANGLADESH and strengthen its rush to the sea. In the

northern part of the Ganga River basin, practically all of the tributaries of the Ganga are perennial streams being fed by the snowmelt of the Himalayan Mountains. However, in the southern part of the catchment basin, located in the states of Rajasthan and Madhya Pradesh, many of the tributaries have significant flows only during the monsoon months of June through September. It is during these times the Ganges is most prone to flooding.

The Yamuna, the principle tributary to the Ganga in India, originates less than 100 mi (62 km) east of the source of the Ganges. It flows to the south and almost parallel to the Ganges for most of its 870 mi (1,400 km) course. They join at the holy city of Allahabad, where they are said to converge with the mythic Saraswati River creating a site of pilgrimage for Hindus. Other major rivers that bring the waters of the Himalayas down to the Ganga are the Ghaghara, which joins near Chhapra in Bihar, and the Gandak, which comes in near Patna.

Within the borders of Bangladesh, the Ganges meets the Brahmaputra (called Jamuna in Bangladesh) and greatly increases in volume. Here the Ganges takes on the name Padma as it continues, creating one of the world's largest river deltas. The Padma splits into innumerable watercourses that are known as the Mouths of the Ganges as they spill into the Bay of Bengal.

Pollution by growing population pressure is the river's greatest challenge. Over 380 million humans live within its catchment basin. Little public sanitation exists to deal with the sewage that is generated. Industrial effluents, many toxic, grow in volume with continued economic development.

Water volumes of the Ganges and its many tributaries can drop significantly during the dry period of the annual monsoon cycle. Lands that are flooded in the wet season must be irrigated by tube well during the dry season, as all arable land must be worked to support such a large population.

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## gender geography

GENDER GEOGRAPHERS, prominent in the discipline since the 1980s, focus their research on the differences between men and women in virtually all aspects of social, economic, and political life and the resulting inequalities that result. The sub-discipline of gender geography has grown dramatically over the past two decades and there is a specialty group within the Association of American Geographers (AAG), the main professional organization, which has gathered significant numbers of researchers: the Geographic Perspectives on Women specialty group (GROW). This organization is well represented at national and regional AAG meetings and it has its own newsletter and website.

Gender geography has its roots in the compelling women's rights movement of the 1960s and the emergence of feminist theory in the social science disciplines. Gender research examines the ways in which gender inequality has emerged. In particular, the focus in gender geography is on the oppression of women, as evidenced in the differences seen in the attitudes and behaviors of men and women in the traditional settings of home, workplace, and social situations.

The capitalist economic system underwent significant changes in the 1980s. These changes brought about equally significant changes in the traditional relationships that existed between men and women. The workplace began to open up to more women and more women sought and gained political office. Women in middle-management positions began to strive for loftier roles in their organizations. In many cases, they encountered what is called the "glass ceiling," a limit to how high they could rise in the leadership of an enterprise. Prior to the dramatic economic changes seen in the 1980s, women's roles were clearly identified. The work world predominantly found in urban places was the realm of men, while home and a neighborhood or suburb were the places for women. As such, women were marginalized with limited access to opportunities outside the home.

A woman with preschool-age children was even more restricted. In order for her to engage in the workplace, she needed to find adequate day care for her child and ensure that she had an automobile for the trip to and from work. If the family had only one automobile, tradition held that the man would have preference for its use. The male workplace in the city in many cases was in a building that was unsafe for women to approach and enter. Relatively inaccessible entries and

long, unattended corridors put women in a position of perceived danger. The work of gender geographers focused on these situations, brought them to light, and advocated for change.

### A NEW LOOK AT GEOGRAPHY

Gender geography is concerned with the oppression of women and inequalities that are found in their treatment in the economic and political sectors. The approach of gender geography, however, is not to be limited to the development of geographies of women but to bring about changes within the discipline of geography itself and, where necessary, to challenge the existing theory and practice within the discipline and bring them into line with gender findings. Challenges have been made as well to current research practices and methods of teaching that are perceived to reflect a strong masculine bias within geography.

The aim of the gender geographers, then, is to ensure that their perspectives inform all of cultural and human geography. Cartography is a case in point. Research suggests that a strong masculine bias exists in maps and that little mention is made of women in the discipline. There is compelling evidence, it is contended, that the role of women in geography and cartography has been far more extensive than has been reported to date. There is further evidence that abundant information on the status and experiences of women is available on existing maps that have remained relatively unused in geographical research.

### INTERNATIONAL STUDIES

The 1990s brought forth a number of significant studies on the status of women in the world. Some of the most heart-rending outcomes of these studies point to the deplorable social and economic conditions experienced by women in the developing regions of the world. These studies provide an abundance of evidence to support the claims of the gender geographers centering on the oppression of women and the clear dominance of masculine bias. Rates of illiteracy are much higher among women in developing countries, a direct reflection of the generally lower number of years of school attended by women in these regions.

An extreme example of the plight of women was exposed during the recent war in AFGHANISTAN. Under the Taliban regime, women were not allowed to go to school, they could not gain employment, and they were required to wear a burkha, a garment that covered them from head to foot. Other studies have pointed out that far more women are malnourished worldwide

than are men. Ironically, women grow 50 percent of the world's food. In some African countries the figure approaches 80 percent. Perhaps the most telling indicator of male bias is the practice of female infanticide. Many regions of the world have such a strong bias toward having male offspring that female babies may be destroyed in hopes that a subsequent pregnancy will yield a male child. This practice is especially favored in CHINA and INDIA.

In 1979, CHINA instituted a national policy dictating that families have only one child. As expected, female infanticide increased dramatically into the early 1990s, when the Chinese government relaxed this stringent policy. The United Nations International Conference on Population and Development (1994) in Cairo drew attention to the plight of women worldwide. Policies were instituted that aimed at giving women more control over their own lives through the achievement of economic equality and opportunity, a greater voice in reproductive decisions, and increased access to education. These policies marked a departure from previous pronouncements, which were limited to the implementation of population control measures.

In September 1995, the Fourth World Conference on Women was held in Beijing. A strong declaration of women's rights and equality marked this event. Topics addressed included sexuality and childbearing, violence against women, discrimination against women, and the assurance of women's equal access to opportunities in the economic system. Specifically, these included access to land ownership, availability of financial credit, vocational training, information, and communications.

### UNITED NATIONS MEASURES

The United Nations (UN) set of Human Development Indicators (2003) contain two compilations directly applicable to gender geography. These are the UN Gender-related Development Index (GDI) and the UN Gender Empowerment Measure (GEM). The GDI is a composite index measuring achievement in three basic dimensions: a long and happy life, knowledge, and standard of living. The actual measure of these goals is gained from data on life expectancy at birth, adult literacy rate, and estimated earned income.

Gender differences are greatest in the developing world. Estimated earned income strongly favors males, even in the developed countries, in some cases, double that of women. With few exceptions in the developing countries, adult male literacy rates are significantly higher than that of women. The only category that favors women is life expectancy. Throughout the world,

women on average tend to outlive men. The GEM measures gender inequity using three basic dimensions of empowerment: economic participation and decision making, political participation and decision making, and power over economic resources. In all three dimensions throughout the world, women significantly lag behind men.

In the category of seats in government held by women (as percent of total), the highest figure is 45.3 percent in Sweden. The remainder of the developed countries report percentages ranging from 10 to the mid-30s. As would be expected, percentages in this category in the developing countries are much lower. The percentages of women occupying professional and technical positions (as percent of total) are more equitable. In fact, some countries (ICELAND, UNITED STATES, CANADA, DENMARK, NEW ZEALAND, and ISRAEL) have more women than men in these categories. Surprisingly, a number of developing countries also have more women than men in these roles (NAMIBIA, MOLDOVA, HONDURAS, and BOTSWANA).

However, the category of earned income is decidedly in favor of men. AUSTRALIA, FINLAND, and LATVIA have the highest ratios of female to male earned income: 0.70. All other countries in the world are below that figure, with some as low as 0.30. Clearly, earned income is a category worldwide that strongly favors men. The GEM ranked only 70 of the world's countries mainly because sufficient data either was not available or was not submitted.

Some of the GEM data have been transformed to map form. The map of managers and administrative positions shows the highest percentages of women in North America, AUSTRALIA, New Zealand, SOUTH AFRICA, and several European countries. The lowest percentages are in the MIDDLE EAST, over half of the African countries, and the Indian subcontinent. It is clear that women remain a distinct minority in the exercise of economic power and decision making. It would appear likely as well that the goal of equality for all people in the world would not be realized soon.

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## geographic database

A GEOGRAPHIC database can be defined as a catalog that stores data that are spatially referenced. These databases are collections of similar data that are related either through location, data structure or type, or common underlying purpose.

Geographic databases can be divided into two main data concepts, graphic and nongraphic. Nongraphic data is data that does not “describe” or “define” graphic images or map features. There are four types of nongraphic data: attributes, geographically referenced data, spatial relationships, and geographic indexes. Generally, nongraphic data attributes describe particular map features or are linked to graphic elements through identifiers or geocodes. An example of an identifier or geocodes would be used to describe items or actions at a geographic location such as building permits, accident reports, or tax records. Nongraphic data within a geographic database can take the form of a geographic index or be used to describe a spatial relationship.

Examples of geographic indexes include street addresses, mailing addresses, parcel numbers, or account numbers. Spatial relationship examples include various topological relationships such as connectivity, adjacency, and proximity. All of these elements of nongraphic geographic data are stored in geographic databases as alphanumeric characters.

Graphic data in geographic databases consists of points, lines, polygons, and other map or cartographic features such as projections, coordinate systems, and cartographic symbols. Graphic data is commonly stored in the database in the form of coordinates, symbols, rules, or pixels. There are two methods in which graphic data can be stored within a geographic database: vector or raster. Vector data are denoted by coordinates (example, x and y or latitude and longitude) of nodes and lines or rules for connecting the various lines

into areas. Vector data defines objects, polygons, and other involved units so that they can be displayed or analyzed based upon their associated attributes. Raster data sets are stored as a set of uniform grid cells that represent a continuous surface.

There are many different forms that data models or bases can take. Some of the more basic and widely used ones are hierarchical, sequential, and relational. Hierarchical data models can take the form of parent-child relationships or one-to-many relationships where, for the database to be successful, direct linkages between entries are necessary. Relational data models consist of relational tables where rows are records, columns define the attribute relation, and each cell has a particular attribute value.

Management of geographic databases is very important to help ensure the accuracy of the data, the integrity of the database, and the reliability of the analysis done using a particular database. Included in this management of the database is establishing data standards, definitions, quality, and maintenance schedules. Administrators of digital geographic databases are also charged with controlling access and use of the database, backing up the database and creating and maintaining a data directory or dictionary. The data directory, also referred to as metadata, is essential to the management of a geographic database. Information included in a data directory is the definition of the particular entities, attributes and valid values. Data directories also describe the various entities and attributes when necessary, along with describing the accuracy, completeness, or other data characteristics that are important the integrity of the database.

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## geographic information system

GEOGRAPHIC INFORMATION systems are widely known by their abbreviation, GIS. The most popular definition of GIS is: a computer-assisted system for the acquisition, storage, analysis, and display of geographic data. Conceptually, GIS has been defined as

the digital representation of the landscape of a place (a site, a region, a planet), structured to support analysis.

A functional GIS necessarily incorporates software capable of handling geometry, attributes, and topology. Geometry consists of points, lines, and areas that represent places and geographic features located within those places.

Two distinctly different data structures are employed, and each system must be capable of converting or integrating the other. Raster data structures consist of regular grids of intersecting lines that form rectangular cells. In raster GIS, points are represented as individual cells, lines as chains of cells, and areas as patches of cells. Raster GIS is well suited, for instance, to represent satellite imagery collected by electronic scanners or survey samples collected in regular arrays by field investigators.

Vector data structures consist of individual points plus complex geometric structures comprised of points (typically called nodes) and line segments connected by vectors. Vectors are not restricted to right angles. Point features are expressed in latitude, longitude, and elevation or some other coordinate system convertible to such Earth coordinates. They may include, for instance, the corners of land ownership parcels and the intersections of transportation lines. Line features are expressed as points (usually called nodes) connected by line segments. They may include, for instance, road center lines, flight lines, and trajectories of all sorts. Area features are expressed as points and chains of line segments that close to produce polygons. They may include, for instance, administrative areas, ownership parcels, and bounded areas such as fields or forests.

In raster and vector GIS, attributes describe the characteristics of geographic features. Physical attributes may include, for instance, material (e.g., rock, soil, water, ice), temperature, and color. Cultural attributes may include, for instance, religion, language, and ownership.

Topology (not to be confused with topography) represents angular relationships (order, adjacency, etc.) that remain constant regardless of map distortion. Topology is essential if geographic data from different sources, scales, and projections are to be combined in a single geographic analysis.

A commercial GIS primarily consists of software for handling these functions. While some GIS vendors provide sample data or even real geographic data for broad regional coverage, it is generally expected that purchasers will use the GIS software to develop databases tailored to their own locale and analytical needs.

In Western society, people are constantly confronted with practical examples of GIS, but many do not know the term or recognize its many forms. Examples of GIS and its products include automobile navigation systems, geographic profiling in criminal investigations, tax assessment systems, digital weather maps, and even the U.S. military's precision weapons employed in the war in Iraq.

GIS products are overwhelmingly beneficial to society, but certain applications raise serious concerns about privacy and control. Some products currently on the market are advertised for "human tracking" and undoubtedly will be used to monitor and control the locations of individuals. Some applications will be ethical, others will not.

The science behind GIS is geography. On most university campuses, the principal GIS courses are offered in geography departments. The development of GIS, however, has involved a much larger community of spatially oriented disciplines (e.g., cartographers, topologists, and landscape architects), domain scientists (e.g., geologists, foresters, and ecologists), and computer scientists. Broadly, these developers and practitioners refer to their field as geographic information science, often distinguished as GISci.

Geography has been practiced for at least 2,500 years, starting with the ancient Greeks, and it has always been inhibited by the enormous volumes of data required to represent landscapes and regions. GIS enables a new form of automated geography that is revolutionizing society's capacity for understanding and managing just about everything for which location matters, including everything, human or otherwise, that moves or flows.

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## geomorphology

GEOMORPHOLOGY IS the study of landforms. Landforms are surface expressions of rocks, as are various features made by rivers, groundwater, waves and currents, winds, glaciers, and corals. Landforms come in all shapes and sizes. A DELTA, PLATEAU, VOLCANO, sinkhole, and beach are all landforms. Geomorphologists are geologists and physical geographers who specialize in the study of landforms.

Geomorphology has two general goals: 1) to explain how landforms vary from place to place; and 2) to develop theories about the origin and development of landforms. In order to achieve these goals, geomorphologists examine the nature of surface rocks and geologic processes, such as soil formation, weathering and EROSION, mass movements, and transportation and deposition of sediments. They use a wide range of techniques for data collection, including field, laboratory, and numerical techniques. Geomorphologic research aids in understanding the role that landform development plays in complex ecosystems. The findings also help prepare for and lessen impacts of hazardous geological events, such as landslides, FLOODS, beach erosion, and slope erosion. The following paragraphs summarize how geologic structure, PLATE TECTONICS, gradational processes, and time influence landform development. The four factors are interrelated so that their combined effects create an amazing variety of beautiful landforms for us to enjoy. The article concludes with a summary of how geomorphic theory in the United States evolved from a long tradition of geological and geographical research.

### GEOLOGIC STRUCTURE

Landforms vary, in part, because of geologic structure. Geologic structure refers to the types and arrangement of materials that make up landforms. The materials are extremely diverse, ranging from sediments, such as finely textured clay deposits on a glacial lakebed, to massive large-grained rock that has crystallized from subsurface magma. There are three basic types of rock—igneous, sedimentary, and metamorphic—but each type has a wide variety of examples that differ according to their chemistry, texture, color, hardness, and so on. Common examples of sedimentary rocks are conglomerate, sandstone, siltstone, shale, and limestone.

Igneous rocks form when liquid magma (molten rock) cools and hardens. In the hardening, minerals take on their shape, or crystallize. There are two basic

subcategories of igneous rocks—intrusive and extrusive. When the magma cools within Earth's crust, the rocks are of the intrusive igneous type. Granite is the most common rock of this type. When magma erupts onto Earth's surface, it cools outside the crust to become an extrusive igneous rock, or lava. Basalt is the most common type of lava.

Metamorphic rock forms when intense pressure and heat cause previously formed rocks (including other metamorphic rock) to deform or metamorphose. (*Metamorphose* in Latin means “to change form.”) Different rocks have their own metamorphic counterparts. Sedimentary rocks, such as limestone and dolostone, change to marble. Low-grade shale becomes sheets of slate, and sandstone turns to quartzite. Metamorphism may occur in igneous rocks as well. Granite recrystallizes to become banded gneiss (pronounced “nice”). Intense heat and pressure can also turn several kinds of sedimentary rocks or their metamorphic products into gneiss. *Schist* is a general term for a group of metamorphic rocks that forms under the most intense pressure and heat.

Earth materials exhibit even more variation in their arrangement. Joints divide rocks and internal forces (compression, tension, and shear) break them along faults, thrust them vast distances horizontally, or deform them by heat and pressure. Rocks may or may not be in layers. Sandstone has layers, but granite is a massive rock devoid of them. Layers of sedimentary rocks may be horizontal, tilted, or folded. Rocks also differ in the degree to which they yield to weathering and erosion processes. Hard rocks and soft rocks wear down to differing degrees. Ridges and peaks occur where hard rocks resist the work of weathering, rain, and streams. Valleys that separate the ridges are where rocks are weak. The rocks in valleys weather easily and streams wash their sediments away quickly.

The arrangement of most sediment varies according to a transporting agent (stream, wind, waves, or glacier). For example, meltwater discharging from a retreating glacier deposits stratified (water-sorted) layers of clay, silt, sand and gravel, but it also leaves behind piles of unstratified (unsorted) debris, ranging from clay to boulder-size materials. Like glacial meltwater, other transporting agents stratify or sort their deposits. Rivers form FLOODPLAINS and deltas; waves leave behind beaches and spits; and winds deposit sand dunes and loess (silt deposits). In contrast, layers of sediment left by corals and groundwater are in situ deposits (the sediments remain at their point of origin). Corals leave behind their skeletons to form limestone reefs, and

groundwater forms various types of calcified deposits, such as stalagmites and stalactites.

## PLATE TECTONICS

Geomorphologists have a big-picture view of the origin and general distribution of landforms through the study of plate tectonics. Plate tectonics refers to the movement and interaction of plates, which are sections of Earth's lithosphere (outer rock layer). Plate movements explain the origin and present distribution of expansive plains, plateaus, volcanoes, and mountain systems, as well as continents and ocean basins. Plates move slowly—generally less than 10 in (4 cm) per year. Nevertheless, their incremental movement over millions of years moves continents and opens and closes vast oceans. Driven by Earth's internal heat energy, tectonic plates have collided and separated several times to create and arrange rocks.

Since the 1960s, geomorphologists have become increasingly knowledgeable about how tectonic plates move and interact. They now understand that mountain-building activities (earthquakes, folding, faulting, and volcanism) occur more often at the edges of plates, where they come together, move apart, or slide past each other. The word *tectonic* is an apt name for these landform-building plates. In the Greek language, *tec-tonic* means “builder.” The most imposing mountain systems of today—HIMALAYAS, ALPS, and ANDES—are on the boundaries of converging plates. The mountains are primarily a result of folding. Volcanism and faulting, although they can have catastrophic results in folded mountainous areas, are of secondary importance to uplift caused by folding along convergent boundaries.

Volcanism plays a key role in building mountains from the seafloor. Where plates are converging beneath the sea, volcanic island arcs, such as JAPAN, the PHILIPPINES, and the Kuril and Aleutian islands, are forming. Where tectonic plates are moving apart on the seafloor, volcanism and faulting are building the world's largest mountain system—the mid-ocean ridge. Additionally, volcanism also forms volcanic islands where a plate passes over a magma plume that is in a stationary location in the mantle, which lies just below the moving lithosphere. The Hawaiian Islands are a classic example. Where plates slide past one another, strike-slip faulting and earthquakes are the dominant tectonic activities, such as in CALIFORNIA, where the San Andreas Fault Zone is so active.

Continental SHIELDS occur away from the edges of plates, where the Earth's surface has been subject to lit-

tle or no tectonic activity. Shields are landscapes of low plateaus and hills. They are composed of ancient rocks that have escaped the destructive forces of plate movement. There are two types of shields—covered and exposed. Covered shields are under a cover of younger sedimentary layers. These strata accumulated at times when the shields subsided and shallow seas inundated the land. Rock-forming sediments from the land (clay, sand, and gravel) and from dead marine organisms covered the shields. Covered shields underlie portions of all of the continents.

For example, sedimentary rocks bury a shield in North America that lies between the Rockies and the Appalachian Highlands. Exposed shields occur where ancient continental rocks lie bare. An example of an exposed shield is the CANADIAN SHIELD of North America. Exposed shields also exist in Scandinavia (lowland SWEDEN and FINLAND), South America (Brazilian and Guiana highlands), Africa, AUSTRALIA, and INDIA.

## GRADATIONAL PROCESSES

The wearing down of elevated areas also influences the nature of landforms from place to place. Relentless erosion by rivers and glaciers has worn down massive mountain ranges, leaving behind only bits and pieces of ancient bedrock. For example, plates collided to arrange rocks of the Appalachian Highlands in eastern North America, as well as highlands in the British Isles, southern GERMANY, CZECH REPUBLIC, and Scandinavia. These areas are actually the roots of mountains that were in the past as magnificent as the Rockies and Himalayas are today. The thickness and age of river-borne sediments that surround the base of these low mountains bear witness to great heights of former summits.

Gradation begins with physical and chemical weathering of rocks and other earth materials. Mass wasting (mass movement) transfers the weathered material downslope. Mass wasting processes include, creep, rock fall, solifluction, mudflows, earth flows, avalanches, and landslides. These processes result from the downslope pull of gravity. Gravity also pulls surface water and glacial ice downslope as they pick up and transport rock fragments produced by weathering. In addition to gravity, solar radiation is an energy source for gradation. It drives atmospheric circulation, which generates storms that produce major erosion agents—rain, meltwater from snow and ice, wind, and ocean waves. Kinetic energy of the erosion agents physically detaches, transports, and deposits sediments to form a variety of depositional landforms: streams de-



posit sediment to form ALLUVIAL FANS, floodplains and deltas; winds deposit sand dunes and loess; waves and currents form beaches; and retreating glaciers leave behind end moraines and outwash plains.

Weathering, mass movement, and erosion transfer sediments from elevated mountains and plateaus to low-lying sedimentary basins. Sedimentary deposits cover vast areas of continental lowlands, coastal plains, and submerged continental margins. Examples of sedimentary basins in North America are the U.S. Central Lowlands region—which includes the interior lowlands of OHIO, INDIANA, ILLINOIS, and IOWA; the Mississippi delta; and the Gulf Coastal Plain as well as the continental shelf beneath the Gulf of Mexico.

### THE STUDY OF TIME

Landforms of the same type differ in appearance because they are in different states of change. Geomorphologists study change in landforms in terms of response times and restoration times. Change in a sandy beach is an example. The time a beach takes to adjust to erosion brought about by a storm's wave energy is its response time. The time required for restoration of the beach to its former shape is its restoration time.

At any given moment, a beach's shape reflects a balance between inputs and outputs of energy (waves) and mass (sand). Storm waves create a negative sediment budget by taking away large amounts of sand. Beaches respond to storm waves by becoming steeper and narrower, but they rebuild quickly after the storm subsides, when smaller waves bring in surplus sand. Such adjustments establish a new equilibrium between the landform (beach) and the process (wave action) affecting it.

The rates of response and restoration among landform types are wide-ranging. A beach typically responds to storms and restores itself in a matter of days, weeks or months, depending on the strength and frequency of storms.

In cases where restoration times are very long, the land may have "leftover" relicts of processes that are no longer active. For example, tectonic or climatic processes that cause the sea level to change may have ended tens of thousands or even hundreds of thousands of years ago. Consequently, coastal areas have relict forms of old shorelines, such as marine terraces and beach ridges. Relict landforms may require a million years or more of gradation by other processes for their removal. Removal of such relicts may never occur, as a resumption of tectonic activity and glaciations

tend to interrupt restoration intervals of these magnitudes.

### THEORIES OF LANDFORM EVOLUTION

U.S. geomorphology experienced spectacular growth from about 1890 to about 1950. American academics recognized W.M. DAVIS (1850–1934) as the leading specialist in the field during this period. Davis developed the technique of "explanatory description" of landscapes. He discouraged experimentation in processes of landscape evolution, because he felt the processes were too complex and landform types too varied. His methodology focused instead on describing three controlling factors of landscape change—structure, process, and time. Davis devised one of the earliest models of landscape evolution—the geographical cycle.

The model posited that landscapes evolve through a sequential series of stages; each stage possesses an indicative set of landforms. Purely descriptive in origin, the observer was supposed to use the model to determine the stage of development of a particular landscape. Followers of Davis conducted few experimental studies on processes, for his descriptive system was deceptively adequate. Intuitive reasoning outpaced investigational proof during these early years.

World War II introduced improvements in aerial photography and new kinds of geomorphologic analysis. Accurate quantitative interpretation of beaches and coasts using aerial photographs were vital to military strategy during the war. Beach studies carried over after the war and led the trend in quantification and experimental verification. A concern for streams, the main suppliers of sand to beaches, was a logical extension of shoreline studies. Thus, the dynamics of weathering rates, stream erosion, and slope development quickly became a major focus of the new approach.

By the late 1960s, quantitative models had all but supplanted Davisian-type descriptive models. In subsequent decades, the role of climate in the genesis of landforms received more interest. Additionally, new technologies involving the study of the ocean floor validated the unifying theory of plate tectonics. Theoretical geomorphology in the United States has used the systems theory approach and has focused on developing quantitative models that replicate and predict geological processes. Geographic information systems, remote sensing, global positioning systems, and isotope dating have accelerated this trend.

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## geopolitics

GEOPOLITICS IS POLITICS taking place in regard to geographical circumstances, territorial relations and aspirations of political entities. It derives from the spatial settings of place as well as from territoriality as a universal dimension of human (and animal) behavior. While the spectrum of geopolitical action is very wide, it is never just derived from "geographic imperatives." There are always underlying motivations, constructions and lines of thinking behind geopolitics, whether we speak of geopolitical theories or geopolitical action. In order to understand the relational and proportional settings of contemporary geopolitics, it helps to construct some kind of picture of the asymmetric "geopolitical ideologies" that influence the motives and ideas behind the geopolitical activities of various states and other political actors.

At the same time, geopolitics should not be confused with the field of POLITICAL GEOGRAPHY. Both disciplines have in common the search and identification of an area of study that concerns the connection and mutual interaction between geography and politics. Political geography deals with the study of the existing relations between spatial facts and the political processes, and therefore constitutes the spatial analysis of political phenomena. It concerns the spatial attributes of the political process or can be seen as the study of existing relations between spatial facts and political processes. Geopolitics, on the other hand, is an approach to international politics that insists on the significance of geographic territory and its resources. It represents the study of the geographic distribution of power among the states of the international system,

paying particular attention to the rivalries of the major powers. From a slightly different point of view, geopolitics could be seen as an expression of the foreign policies of states, where those policies are determined by the state's location, natural resources, and physical determinants. Thus, geopolitics and geopolitical analysis constitute the study of international politics seen from a spatial or geocentric perspective. Where political geography deals with the interaction of geographical factors and politics, the interactions of political power and space, geopolitics tries to provide a geographic interpretation of these events by studying the geographical aspects of political phenomena.

## BACKGROUND

A Swedish political scientist, Rudolf Kjellen, originally coined the term *geopolitics* in 1899. Kjellen viewed the state as a living organism and, in developing his ideas, saw geopolitics as the study of the state as a geographic organism whose spatial phenomena could be a land, a territory, a space, or a country. Kjellen believed that in order for a state to be strong, its government had to put in practice five complementary types of policies in order to be successful in its natural expansion. For Kjellen, the aim of the discipline was to demonstrate the role of the geographic characteristics in the conception of the state and the practice of statecraft to the statesman and decision maker.

According to Friedrich Ratzel, the state is a territorial entity with two essential coordinates: the space (*raum*), which he viewed as the total surface or aerial extent of territory, and the position (*lage*), which he referred to as the situation of the territory in relation to other states. Ratzel was also interested in two other ideas: the concept of space itself, namely the sense and meaning of space, and what he called vital space.

There is one definition of geopolitics that seems to be particularly well expressed. In the words of Osmo Tuomi, the geopolitics that emerged in the last decades of the 20th century is by no means comparable to the old framework and theoretical points of view, namely the eternal confrontation between sea power and land power developed during the late 19th century and the first half of the 20th. For Tuomi, theoretical geopolitics studies the relation between physical space and international politics, develops models for the spatial division of the world into cooperating and competing parts for historical, economic and political reasons, and analyzes how the participants interpret the political, economic, and military consequences of this division. The geopolitics of a state or other territorially defined soci-

ety relates to its pursuit of geographically dimensioned aims that are connected with its economic and political position, security and culture.

With the end of World War II, new perspectives emerged for the study of geopolitics and political geography. The international system in the postwar period changed dramatically the notion of the balance of power and introduced strategic bipolarity and nuclear deterrence, concepts responsible for the ideological, political, cultural, and geographic confrontation between the two superpowers and the respective spheres of influence and blocks of allies. It was during this period that geopolitical theory cut drastically with the international situation that had prevailed up to that time, and the realities of the world situation were constantly assisting the development of new weapons, strategies, and techniques for conducting war.

The resurgence of both political geography and geopolitics began in the late 1960s and early 1970s as they ceased to be mere instruments in service of the military establishment/sphere and started to be objects of analysis by academics and researchers who wanted to construct critical reasoning and discourses with respect to the disciplines in question. The renaissance has been particularly manifest after the end of the 1980s, compared with the exclusion and distancing that it suffered after 1945 and for approximately three decades thereafter.

As one legitimate area of study, geopolitics and political geography deal with complicated if not problematic issues like GLOBALIZATION, deterritorialization through constant flows of information and finance, and transnational phenomena that transcend the boundaries of states and seem somehow to erode the concept of sovereignty itself.

In some respects, we live in a world that is becoming boundless, without physical and territorial borders, that bases itself on an increasing, more frequent, and perceptible interdependence among players. In this sense, some authors speak about the end of geopolitics because of profound impacts created by economic globalization. Information technologies and communication are progressively forming and reforming domestic politics and the foreign relations of states, raising doubts about the existence of borders, boundaries, territorial demarcations, and sovereignty itself.

Another major change in the study of geopolitics and geopolitical analysis started in the late 1980s and continued throughout the 1990s: Critical geopolitics. This line of study demonstrates that geopolitical issues and themes can be found in popular culture, movies, or

mass media, that is, the press, TV and radio. These same issues are therefore seen as important forms of popular geopolitics. In comparison to formal geopolitics, the insight of critical geopolitics tries to determine in what manner and to what extent geographic labels do not imply some strong causal relation between physical geography and the behavior of the state and its political structures.

For some theorists, critical geopolitics takes issue with the traditional theories of political geography and opposing positions of geopolitical theories by analyzing their discourses and their role in spatial formation and development. In order to achieve an alternative form of geopolitics, one that intends to serve as the equilibrium in the hegemonic balance, the critical approach offers an examination of the suppositions that sustain particular geopolitical constructions, that is, production and use of geographic knowledge in various orders of power and space. In doing so, critical geopolitics tries to uncover the hidden geographical assumptions in foreign policy decisions and actions.

Following the fall of the Berlin Wall and the demise of the old Soviet system in 1991, a new phase in the international system of states began to take form, thus paving the way for the end of communism as a socio-economic doctrine and a new orientation in foreign policy. The revival of geopolitics and political geography after years of relative neglect has highlighted primary concerns such as the role of geographical scale in establishing political identities. New threats to world security emerged, like regional conflicts, violent nationalism, religious fundamentalism, and sharp inequality between the rich north and the underdeveloped south.

Some authors believe we live now in a more unpredictable and unsafe world. The disintegration of the Soviet empire has created a vacuum on the huge land-mass that was Mackinder's HEARTLAND. And that heartland was also the region that in the past was the heart of the country with which the United States was struggling for global primacy. Geopolitics has once again gained special attention from Russian scholars and policy makers.

And once again, the concept of the heartland is retaining its credibility among Russian authors. Here is demonstrated the high interest in geopolitics, where the Eurasian theory provides a simple definition of the belief that RUSSIA is a unique power and does not need to Westernize in order to "obtain" and reach modernity. At the same time, the orthodox version of geopolitics means the Eurasian heartland is, in geographical terms, the milestone for the formation of an anti-Western

movement, whose aim once again is to ultimately expel the “Atlantic” influence from Eurasia.

Today, geopolitics is a concept built on a plurality of issues within the theoretical framework of international relations and its study. In a widely interdependent and rapidly transforming world characterized by extremes in complexity, geopolitical perspectives can be very useful in defining the international system. This is particularly so with regard to the extent to which geopolitics is able to provide useful explanations of, as well as point out barriers and obstacles to, stable geospatial relations.

In this sense, geopolitics should be taken seriously, for it constitutes in itself a social element and a technological reasoning that helps in the construction of our images of the world. According to John Agnew, this imagination has provided meaning and rationalization to the practice of geopolitics to the extent that it has defined the ideological space from which the geographic categories upon which the world is organized and work are derived.

Geopolitics and political geography then simultaneously justify and legitimate a confrontation like in the days of the Cold War or give a picture of the inequalities that characterize the present (and past) world economy with regard to the representations of a world without limits, borders and boundaries. In the present state of the world, frontiers and borders seem to vanish because of the changes around the notion and function of territoriality. This points as well to the processes of *globalization*, a term highly used (and abused), but also a sometimes ill-defined one that can confuse all forms of economic, political, and cultural theories. The functions of the border and the sovereignty of the state are rendered less important and are therefore reduced to a more irrelevant perspective.

## HISTORIC FOUNDATIONS

In a sense, geopolitics attempts to explain why some countries have power and other countries do not. This basic focus is clearly not new to the modern world. For as long as there have been human societies, there have been groups with power and control and those without. In many regards, this social psychological view of human spatial behavior can be seen as a history written in the language of territory and territoriality, both of which are natural expressions of humans as biological forms.

The special connection between the spatial qualities of countries and international relations has been observed since the Greeks. The Greek geographer and

philosopher Strabo believed that geography was destiny, and that the presence of a given set of geographical circumstances automatically led to some form of political order.

The ancients were true ecologists, for they assumed a strong organic relationship between environment and society. In his book *The Politics*, Aristotle remarked on the impact of climate on human character and, ultimately, politics by indicating that it requires no stretch of logic to see geography and topography as both antecedent to and resultant of climate. But not everyone agreed. Writing in the 16th century, Jean Bodin took exception to the Aristotelian belief in the dominance of geography, arguing that reason, as exercised by statesmen, could overcome the tyranny of geography. Not long after, however, Napoleon Bonaparte returned to the original view, with a bold belief that the politics of a state is its geography.

The formal link between geography and political science that we drawn upon today began a little more than 100 years ago, when the idea of geography being destiny received new emphasis and a name (geopolitics) from Rudolph Kjellen, a Swedish political geographer. Under the general influence of the Age of Reason and a belief that science could be applied to benefit human society, Kjellen sought a science of international politics grounded in empirical bedrock. And for Kjellen, what better bedrock could be found than geography? In short, Kjellen's motivation was bound up with the contemporary conviction that serious inquiry needed to be linked to science rather than to the traditional conception of the humanities.

In 1890 Alfred Thayer Mahan wrote *The Influence of Sea Power upon History*, spelling out the necessity of sea power in facilitating trade and peaceful commerce. Mahan, therefore, believed that the country that could control the seas possessed the greatest power in the world. Thus, the development of a strong navy was an essential ingredient to a powerful state in addition to the country's location. Geographically, this meant that the country with the most power would be the one whose relative location was accessible and connected to other areas via a long coastline and good harbors. Mahan also saw the expression of this power as belonging north of the Suez and PANAMA CANALS.

The late 19th century was a period where the social sciences began to embrace the notions first identified by Charles Darwin when he wrote *Origin of Species*. This evolutionary approach took hold in many schools throughout Europe, particularly in Germany, which believed in a kind of social Darwinism as a working ex-



planation for the evolutionary development of the states of the world, European countries (GERMANY) being the ultimate expression of the theory. The Germans became instrumental in developing this new idea into the field of geopolitics (*geopolitik*) and modern statecraft. In 1897, German natural scientist Friedrich Ratzel developed his “organic theory,” contending that the state is like an organism that is attached to the Earth and that it competes with other states in order to survive. Further, like all living organisms, the state needs living space or *Lebensraum* in German.

Also in the late 19th century, Sir Halford MACKINDER proposed what has become the most widely discussed concept of geopolitics. Mackinder was interested in political motion, observing that the spatial distribution of strategic opportunities in the world was unequal. In his 1904 book *Democratic Ideals and Reality*, Mackinder developed his thesis with a disregard for Mahan’s theory, suggesting that advances in technology were forcing a reevaluation of both spatial concepts and military strategies. As an example, he indicated that with the development of railroads, countries no longer needed to depend on the navy to move large armies. Accordingly, Mackinder believed that the focus of warfare would shift from the sea to the interior portions of countries and continents; something he called the HINTERLAND.

Mackinder then developed the idea of a “pivot area,” located in the northern and interior parts of the Eurasian continent where the rivers flow to the Arctic or empty into salt seas. This area would be pivotal, he believed, as it would be easy to defend and hard to conquer. In later works, he began to refer to the pivot area as the “heartland,” and devised his famous Heartland Theory. According to this theory, Mackinder believed that “He who controls the Heartland controls the World Island (Eurasia and Africa) and he who controls the World Island, controls the world.”

Another German, Karl Haushofer, was a leading proponent of Mackinder’s Heartland Theory and developed a theory around the idea of pan regions. Haushofer divided the world into three pan regions, blocs of power, based on the complementarity between North and South. His ideas represent an early conceptualization of the CORE AND PERIPHERY concept, where a northern core would be connected to a southern periphery. The three pan regions were Anglo-America with Latin America as the periphery; Europe (which he saw as controlled by Germany) with Africa and INDIA as peripheral areas; and JAPAN and its periphery, Southeast Asia. After World War I Rudolf Hess heard

Haushofer’s lectures and later introduced him to Adolf Hitler, who ignored the subtleties of Haushofer’s teachings and used these geographic theories to advance the Nazi cause.

After World War II the study of geopolitics fell into disrepute because of its association with Nazi Germany and the fact that geopolitical theory ascribed a single cause to the success or failure of a country and that did not take into consideration human choice. This was known as determinism, later to be more fully developed as environmental determinism with geographic factors as the foundation for “environment.”

Nicholas Spykman was a proponent of this environmental determinism approach, integrating economic, political, and military points of view into the theory. According to Spykman, states with locations north of the equator would always be more important than those south of the equator. Spykman also disagreed with Mackinder’s Heartland Theory, believing that both sea and land power were important. In advancing his ideas, he believed that the real potential of Eurasia was in the “inner crescent,” a region that included Western Europe, the MIDDLE EAST, South Asia, Southeast Asia, and the Far East. He called this region the Rimland, suggesting that its importance lay in the fact that the region had access both to the sea and to the interior regions. Spykman extended Mackinder’s reasoning on the importance of the Heartland by stating: “Who controls the Rimland rules Eurasia; who rules Eurasia controls the destiny of the world.”

During the Cold War years, policy makers relied on the Rimland Theory as justification for the policy of CONTAINMENT, that is, at stopping the spread of communism. Unfortunately, this led the geopolitics movement in America to take on highly simplified and distorted views whose primary purpose was to serve political ends. Geography was somehow pushed out of the geopolitical equation during this period, when it like economics and other social sciences, began to seek more refined scientific status through mathematics and the development of regional science. Practicing geopoliticians were now chosen from such fields as international relations and history, sometimes even from the military, but not from geography. Geography meant distance, size, shape, and physical features that were all static. The idea of geography as spatial patterns and relations that reflect dynamic physical and human processes was absent.

In an extension of conceptual ideas first developed by Mahan for sea power and later by Mackinder with reference to railroads, A.P. de Seversky, writing in *Vic-*

*tory through Air Power*, believed that the development of air power made land battles obsolete. His contention was that whoever controls the skies would control the world. At the time of his writing, the United States and the Soviet Union were the two most important air powers. He used an azimuthal equidistant projection centered on the North Pole to show the air dominance of the two countries. He went on to indicate that there was an area of intersection visible on the map that he called the “area of decision,” and that whoever controlled this area would be the dominant geopolitical power in the world.

### WALLERSTEIN'S WORLD SYSTEM

During the 1970s, Immanuel Wallerstein developed a world system theory of geopolitics, where the world system was a social system having boundaries, structures, member groups, rules of legitimization, and coherence.

According to Wallerstein, there were two varieties of this so-called world system. One could be viewed as comprised of a world empire where there is a single political system over most of the area. In the other form, there could be several subsystems within the world system, but no single political system existing equally throughout the overall space.

Wallerstein used economics as the cohesive factor in his world system theory and saw the world economy as the base upon which the world system was built; something he believed took original form in Europe during the 16th century and was made possible by a division of labor that was both functional and geographical. Within this world system Wallerstein identified three geographic areas: core states, peripheral states, and semiperipheral states. The advanced countries of the world economy represented core states. They all were believed to have strong state structures, national cultures, and highly integrated populations.

Within the model, trade, technology, and finance connected the economic powers as core states whereby they were also exploiters of the periphery. Peripheral states were weak and typically either colonial states or states with relatively low degrees of autonomy. The third region was comprised of semi-peripheral areas, those places that act as a buffer between the core and the periphery. As a reflection of determinism, Wallerstein believed that the world-system was already fully developed by the 1950s. As such, no country would be able to enter the system and successfully compete, and those countries currently in the periphery would probably never be able to catch up.

The spatial patterns geographers see in the world today are difficult to conceive of as being containable within national boundaries. The world has become an interdependent system where the nation-state is part of a shared area. One of the proponents of this theory is Saul Cohen, who wrote *Geography and Politics in a World Divided*. Cohen divided the world into geostrategic regions, one Maritime Realm, which is dependent on trade and has an external focus, and a Eurasian Continental Realm, which is continental in composition with an interior focus. Within each realm there is a further subdivision into first-order states (the ones that are the most powerful). According to Cohen, Japan, the United States and the European Community represent the current first order states within the Maritime Realm, while CHINA and the Soviet Union are the first-order states within the Continental Realm. Cohen's model also included what he called shatter belt states, which separate the realms or serve to separate regions within the realms.

There were also a group of independent states such as PAKISTAN, INDIA, THAILAND, and VIETNAM, and gateway states that acted as linkages between realms and regions. And finally, Cohen identified states that are asymmetrical. That is, states that are in a region but behave quite differently from the others in the same region.

### MACKINDER'S CONTRIBUTION

Geopolitics analyzes politics, history and social science with reference to geography. Although U.S. diplomat Robert Strausz-Hup's popularized use of the term (for English audiences), the discipline gained most of its attention through the work of Sir Halford Mackinder and his formulation of the Heartland Theory. In January 1904, he introduced his paper “The Geographical Pivot of History” to the Royal Geographical Society. The paper initiated the onset of a new geopolitical era: a method of political analysis, which stressed the importance of geographic factors in determining national interests and international relations.

He questioned traditional perceptions, suggesting that, in the long run, land power was superior to sea power, and he revised the prevailing Eurocentric view of history. During his lecture, he asked his London audience to “look upon Europe and European history as subordinate to Asia and Asiatic history, for European civilization is, in a very real sense, the outcome of secular struggle against Asiatic invasion.”

This theory involved concepts directly opposed to those of Mahan about the significance of navies in

world conflict. The Heartland Theory hypothesized the possibility that a huge empire might to be brought into existence that did not need to use coastal or transoceanic transport to supply its military industrial complex.

If this were so, then such an empire could not be defeated by all of the rest of the world together if they joined against it. The basic notions behind Mackinder's theory involved a change in thinking where the geography of the Earth was being re-divided into a new variation of the notion of the "old world" (most of the Eastern Hemisphere) and the "new world" (the Western Hemisphere and Oceania). The difference was that the archipelagoes that were traditionally able to defend themselves using naval power, Great Britain and, prospectively, Japan, were taken from the old world (the world island), where they had been major players, and added along with the PHILIPPINES, INDONESIA, SRI LANKA, and MADAGASCAR to another part of the world now renamed the "periphery."

The other world islands, AUSTRALIA and NEW ZEALAND, were already part of the "new world" as a result of their relatively short histories and extreme distances from the heartland. Not only was the periphery noticeably smaller than the world island, it necessarily required a great deal of sea transport to function on a technological level equal to that of the world island, given a lack of sufficient natural resources for a developed economy.

### INDUSTRIAL BASTION

Also, the industrial centers of the periphery were necessarily located in widely separated locations, making it rather easy for the world island to send its navy to destroy each one of them in turn, with little chance of a united resistance. The world island could also locate its industries in regions further inland than the periphery, thus providing a well-stocked industrial bastion. This region Mackinder termed the *heartland*. It was essentially comprised of UKRAINE, western Russia, and what today we call Central Asia. Most important in all of this was the fact that the heartland contained the grain reserves of Ukraine, as well as many other natural resources. It could feed and sustain itself for long periods without outside support.

Mackinder's theory outlined a move away from Europe as the pivotal center of history. Instead, it was becoming eclipsed by a new geographical pivot of history, that of the Eurasian heartland. The main advantage of this imaginary center of a world empire, enlarged by the African continent, or world island, was

that it would be invulnerable to direct attack by sea power. Mackinder said that the fate of the world depended on control of the heartland. He suggested that the heartland would be controlled by Russia or a Russian-German combination, shifting the power center from western to eastern Eurasia. However, if Japan and China were to join allegiances, then the centrifugal force in the balance of power might be transferred to Asia alone. One of the more interesting features of Mackinder's theory was his recognition that one did not have to reside in the heartland's pivotal area to control it.

### FUTURE POWER CENTERS

The crossing of cultures and traditions both between Western Europe and Eastern Europe and Europe and Asia marked, for Mackinder, a region of potential strategic importance in determining the power centers of the future. It could be argued that Mackinder's theory was too one-sided. He concentrated on the Eurasian heartland, whereas an opposite heartland could also exist, for example, in America. This could help explain the confrontation of capitalism and communism: the opposite polar being America, which would have a periphery in Europe, South America, and CANADA.

With the collapse of communism and the weakening of Russian dominance over Eastern Europe, Mackinder's theory could be considered a little out of date. Although Russia still maintains considerable influence and indeed some power over countries that were formerly members of the Soviet Union, that influence has waned measurably in Eastern Europe. If the heartland still exists, it no longer dominates a protective circle of support. The battle between Western capitalism and Eastern communism is now progressing toward a combining together, possibly through the EUROPEAN UNION, keeping distinct nationalities but becoming one Europe instead of two.

It could be argued that global mentalities and attitudes are changing. World dominance, imperialism and expansion may no longer be the driving forces behind national and international development, as much as the growing importance of economic integration, global trade, and financial stability. This does not necessarily mean that Mackinder's theory is no longer applicable. It could be that the pivotal heartland has just shifted from one means of control to another, where the new region of focus in the 21st century seems to be "he who controls China's markets, controls the world."

It remains to be seen just how necessary geography and topography really are to sound explanation and analysis of our political world. A general case can be made that such considerations are increasingly less important: that technological innovations in communications and transportation are making geographical constraints less constraining, at least for the industrialized world.

Goods and services are increasingly global in character, and national borders are increasingly porous, giving enormous advantage to administratively flexible market-states but harming and undermining those states that cannot or will not adapt to globalizing dynamics. Military technology for countries at the highest level is also less constrained than ever by geography, topography, and climate. The next generation of scientific-technical advances will accelerate such processes, making the old constraints imposed by geography and topography completely obsolete.

However, while geography may not seriously constrain the United States and a few other advanced societies, it will continue to constrain most of the states of the world most of the time.

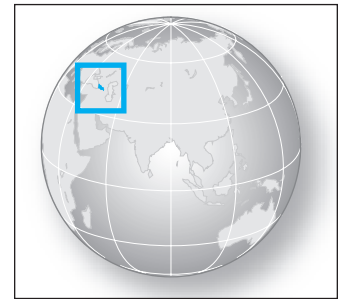
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## Georgia

**Map Page** 1121 **Area** 43,310 square mi (69,700 square km) **Population** 4,934,413 **Capital** T'bilisi **Highest Point** 17,064 ft (5,201 m) **Lowest Point** 0 m **GDP per capita** \$2,500 **Primary Natural Resources** forests, hydropower, manganese, iron ore, copper.



LOCATED IN THE REGION known as the Caucasus or Caucasia, Georgia is a small country, about the size of WEST VIRGINIA. To the north and northeast, Georgia borders the Russian republics of CHECHNYA, Ingushetia, and North Ossetia. Neighbors to the south are ARMENIA, AZERBAIJAN, and TURKEY. The shoreline of the BLACK SEA constitutes Georgia's entire western border. Georgia was absorbed into the Russian empire in the 19th century. Independent for three years (1918 to 1921) following the Russian Revolution, it was incorporated into the Soviet Union and became independent again in 1991.

The Georgian nation represents a fusion of local inhabitants with tribes infiltrating from Asia Minor in remote antiquity. There has also been an admixture of Greek, Scythian, Iranian, and Armenian elements. Ethnic groups in Georgia include Georgian (70.1 percent), Armenian (8.1 percent), Russian (6.3 percent), Azeri (5.7 percent), Ossetian (3 percent), Abkhaz (1.8 percent), and others (5 percent).

### THREE REGIONS

Georgia falls into three main structural regions, which originated in the vast earth movements of the Alpine folding period. In the north is the Greater Caucasus range, in the center a tectonic depression or trough, and in the south the mountains of Transcaucasia. All the southern flank of the Greater Caucasus range, usually regarded as the boundary of Europe and Asia, lies in Georgia, as far east as Mount Diklos-Mta. Although



the highest peak, ELBRUS, lies just over the boundary of the republic, many high peaks are on the crest line: Shkhara, 17,063 ft (5,201 m); Dzhangitau, 16,565 ft (5,049 m); Kazbek, 16,558 ft (5,047 m); and Ushba, 15,453 ft (4,710 m). Many of these peaks have extensive glaciers. Toward the west, approaching the narrow coastal strip along the Black Sea, the range becomes lower. South of the main range is a series of lower ranges, usually roughly parallel to it and separated from it and from each other by deep valleys and gorges. From west to east the chief of these ranges are Gagrinski, Bzybiski, Abkhaz, Kodorski, Svanetski, Metrelski, Lechkhumski, and Rachinski. Farther east, the Suramski Kartalinski and Nakhetinski ranges are perpendicular to the greater Caucasus.

The rivers, which mostly rise in the ice field, are many and fast-flowing, the largest being the Bzyb, Kodori, Inguri, Tskhenis-Tskali, and Rioni, which flow to the Black Sea and the Kura tributaries—Aragvi, Iori and Alazani—flowing to the Caspian. In the extreme northwest is the picturesque Lake Ritsa.

The tectonic trough is divided in two by a saddle formed by the Suramski range. To the west is the wedge-shaped lowland of Kolkhinda, the legendary land of the Golden Fleece. Rioni and other mountain rivers bring an enormous volume of water and silt, which have formed a widespread swamp. East of the Suramski saddle, the trough continues as a series of high, level plains, notably those of Gori and Rustavi, drained to the east by the Kura and its tributaries. The third region, in the south, consists of ranges and plateaus, often called the Lesser Caucasus.

Georgia's climate is affected by subtropical influences from the west and Mediterranean influences from the east. The Greater Caucasus range moderates local climate by serving as a barrier against cold air from the north. Warm, moist air from the Black Sea moves easily into the coastal lowlands from the west. Climatic zones are determined by distance from the Black Sea and by altitude.

Georgia's history is in some respects similar to Armenia's: In both cases small nations have successfully maintained their ancient cultures against successive invaders and regional overlords. Georgia's own Orthodox Christian Church played an important role in preserving the nation's identity, culture, and traditions. The Georgian group of languages is unique and does not belong to any of the major language families. From the 18th century to the present day, Georgia has from time to time turned to RUSSIA for protection and help: Russia's response over the years has varied according

to its interests. Since independence, the people of Georgia have endured periods of civil war related to the independence aspirations of the breakaway regions of Abkhazia and South Ossetia. Although diplomatic efforts have brought relative stability in recent years, tensions over both regions persist.

Georgia's main economic activities include the cultivation of agricultural products such as citrus fruits, tea, hazelnuts, and grapes; mining of manganese and copper; and output of a small industrial sector producing alcoholic and nonalcoholic beverages, metals, machinery, and chemicals. The country imports the bulk of its energy needs, including natural gas and oil products. Its only sizable internal energy resource is hydropower.

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## Georgia

ONE OF THE 13 original American colonies, the state of Georgia was founded by General James Oglethorpe under a charter signed by King George II of England in June 1732. Georgia is bounded on the east by the ATLANTIC OCEAN and SOUTH CAROLINA, on the west by ALABAMA, on the south by FLORIDA, and on the north by NORTH CAROLINA and TENNESSEE. The state is 300 mi (482 km) north to south and 230 mi (370 km) east to west.

Known as the "Empire State of the South," Georgia's 57,906-square-mi (149,975-square-km) area makes it the largest state east of the MISSISSIPPI RIVER. It ranks tenth in population in the country. Atlanta (the capital), Augusta, Columbus, Savannah, Athens, Macon, and Albany are the largest cities in the state.

Georgia's climate is humid subtropical, with long, hot summers and short, mild winters. The state experiences rainfall throughout the year and snow falls occasionally in the northern section of the state, resulting in an annual average precipitation of 50 in (127 cm). During Georgia's hot summers, low levels of precipitation may lead to drought. The mean elevation of the state is 600 ft (182 m) above sea level. Georgia has an annual growing season that ranges from 185 days in the mountains to 250 days in the south.

Six physiographic areas make up the geography of Georgia: the Cumberland Plateau, also known as the Lookout Plateau, which is located in the northwestern section of the state; the Southern Valley and Ridge Region, which is an irregular section located between the Cumberland Plateau and the Georgia mountains; the Southern Blue Ridge Region, which includes sections of both the APPALACHIAN and Blue Ridge mountains; the Southern Piedmont Belt, which is located at the foot of the Georgia mountains, covering most of the northern part of the state; and the Atlantic Coastal Plain, also known as the Sea Island Region, and the East Gulf Coastal Plain, which together cover most of the southern half of the state. The section that divides the Atlantic Coastal Plain from the Piedmont is known as the Fall Line. In this area, the land abruptly drops to sea level, creating rapids and waterfalls that boats are unable to navigate. Georgia has four major soil areas: the Limestone Valleys and Uplands, the Piedmont Plateau, the Fall Line Hills, and the Coastal Plains. Overall, Georgia's soils tend to be sandy and clay loams, ranging from gray to dark red, covering gently rolling hills.

Georgia's major rivers are the Savannah, the Ogeechee, the Altamaha, the Suwannee, and the Chattahoochee. The state has no large natural lakes, but a number of man-made lakes have been created by damming river waters. The largest of Georgia's lakes are Lake Seminole; Walter F. George Reservoir; Lake Sidney Lanier; Lake Sinclair; Hartwell/Thurmond Lake, which is known as Hartwell in Georgia and as Thurmond in South Carolina; and West Point Lake, which Georgia shares with Alabama. Callaway Gardens, one of the state's major tourist attractions, is located near the Little White House in Warm Springs, where President Franklin Roosevelt died on April 12, 1945. Callaway Gardens is located in Pine Mountain, the southernmost foothills of the Appalachians.

Along with Florida, Georgia is home to the Okefenokee Swamp, also known as the Everglades, a 700-square-mi (1,812-square-km) area located in the south-

eastern corner of the state. The swamp was named by the Seminole natives who described it as Land of Trembling Earth. The eastern part of this swamp, which is called the Grand Prairie, is covered with various grasses and water lilies.

This former Confederate state was once known for its cotton output. By the beginning of the 21st century, Georgia's economy centered around the manufacturing and service industries. Atlanta, the largest city, is the major economic, communication, and transportation center of the American South. Also known as the Peach State, Georgia's farm products also include cotton, peanuts, tobacco, pecans, onions, corn, eggs, and soybeans. The state leads the nation in the production of paper and board, tufted textile products, and processed chicken and provides more than half of the resin and turpentine products for the entire world.

Approximately 67 percent of Georgia is forested with trees ranging from the southern pine forest that is home to slash and longleaf pines and live oaks to the cypress and tupelo found in the Georgia swamps, to the hardwoods found in the northern section of the state. Georgia's flowering trees include the redbud, the dogwood, and the azalea.

Wild animals found throughout the state of Georgia include deer, raccoon, opossum, fox and squirrel; black bears reside in the mountains and the southeastern section of the state. Game birds include ducks, geese, and quail, while the mockingbird and the wood thrush are the state's most common songbirds. Minerals found in the state include kaolin, granite, coal, sand, gravel, talc, soapstone, barite, bauxite, manganese, and clay.

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## geostrophic winds

GHOSTROPHIC WINDS blow above the friction layer of the Earth, balanced between pressure gradient forces and the Coriolis force. *Geo*, meaning "Earth," and

*strophic*, or “turning,” refer to the Coriolis force of the Earth’s rotation. The Coriolis force causes wind to bend, eventually equalizing with the pressure gradient force. Geostrophic winds blow aloft and parallel to contour lines, or isobars. Isobars indicate varying gradients of pressure on weather maps, with different areas of pressure identified by isolines. Geostrophic winds occur aloft because land and water affect wind patterns in the friction layer of the atmosphere; they are more likely to occur when winds flow uninterrupted by frictional forces.

Wind is the movement of air molecules from one area of pressure to another. Air pressure is the mass of the air particles in an air parcel. Different pressure areas occur from the heating and cooling of the Earth’s surface, resulting in air parcels rising or sinking. In warm air, pressure increases, and in cold air, pressure declines. Land features and water can also cause pressure changes. The relationship between these differing pressure areas is called the pressure gradient.

Pressure gradient force causes air particles to flow from areas of high pressure to low pressure and seeks to reestablish equilibrium with the constant ideal pressure. The greater the difference in pressure, the faster the particles will move, thus the faster the wind speed.

The Coriolis force, named for French scientist Gaspard Coriolis, results from the Earth’s rotating on its axis. As the Earth rotates, the Coriolis force pulls wind from its intended path, causing it to deflect. This force grows stronger closer to the poles and has no effect at the equator. The Coriolis force affects any free object, such as an airplane or ocean current. In the Northern Hemisphere, the Coriolis force pulls winds to the right, in the Southern Hemisphere to the left. An object’s speed and latitude affect the degree of the Coriolis force, and as an object’s velocity increases, so does the Coriolis force. The Coriolis force affects only wind direction, not speed, and is more substantial over longer distances and larger regions.

Geostrophic winds result from the interaction of the pressure gradient force and the Coriolis force. Above the friction layer, winds are free from interfering obstacles that slow wind speeds and reduce the Coriolis force. Pressure gradient forces increase wind acceleration. As wind speeds increase, the effect of the Coriolis force increases, pulling winds farther and farther from intended paths.

The Coriolis force occurs only when pressure gradient forces set air into motion. Ultimately, the increasing forces of acceleration and direction counteract one another. In the Northern Hemisphere, the Coriolis

force pulls farther and farther to the right until it completely opposes the pressure gradient force, and the net force becomes zero. At that equilibrium, winds blow at a continuous speed, parallel to isobars.

Because geostrophic winds reflect isobaric delineations, wind speed measurements can help determine isobaric contours. Also, by using Buys-Ballot’s Law, an observer can determine the location of high and low pressure areas.

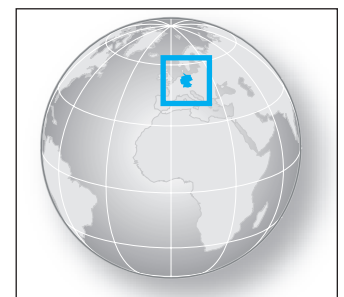
Dutch meteorologist Christoph Buys-Ballot determined the directional relationship between wind and different pressure areas. An observer standing with his or her back to the wind turns approximately 30 degrees to the left. To the observer’s left will be an area of low pressure, and an area of high pressure to the right. Normally observed winds are not often geostrophic, as friction and other forces affect these winds. But by studying geostrophic wind approximations above the friction layer of the atmosphere, meteorologists can learn more about different factors influencing real wind.

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## Germany

**Map Page** 1131 **Area** 137,845 square mi (357,021 square km) **Population** 82,398,326 **Capital** Berlin **Highest Point** 9,721 ft (2,963 m) **Lowest Point** -11 ft (-3.54 m) **GDP per capita** \$26,000 **Primary Natural Resources** iron ore, coal, potash, timber, lignite.



THE FEDERAL REPUBLIC of Germany is one of the largest countries and has the largest population in Eu-

rope after RUSSIA. Germany borders the NETHERLANDS, BELGIUM, and LUXEMBOURG to the west; FRANCE to the southwest, SWITZERLAND and AUSTRIA to the south; the CZECH REPUBLIC to the southeast; POLAND to the east; and the Baltic Sea, DENMARK, and the North Sea to the north. Germany is a federal republic that reunited with the former German Democratic Republic in 1990. The legislature is a bicameral parliament consisting of the Bundestag, based on popular representation, and the Bundesrat, which represents Germany's 16 states, or Lander. The president serves as head of state, while the chancellor serves as the head of government. The major cities of Germany are Berlin, Bonn, Frankfurt am Main, Hamburg, Dusseldorf, Cologne, Munich, and Dresden.

Germany is divided into three regions: the northern lowlands, the central highlands, and the southern alpine region. The northern lowlands extend from east to west from the Baltic to the North Sea and southward to Wittenberg. The northern lowlands are mostly flat plains with marshes and lakes. The land is fertile and has been used for grazing and agriculture. The central highlands are mountainous and forested. The Harz Mountains straddle the center of Germany and once formed the border between East and West Germany, while the Erzgebirge Mountains form the boundary with the Czech Republic. To the west is the RUHR VALLEY, which contains Germany's mineral wealth and is the center of its coal and steel industries. In the center of Germany lies the Thuringian Forest. To the south are the Bavarian Alps, which form the border with Austria. The Black Forest lies in southwestern Germany in Bavaria.

Rivers play a significant role in the economic life of Germany. The RHINE, which carries more traffic than any other European river, flows northward from Switzerland, straddles between France and Germany, and empties to the North Sea. The Elbe River begins in the Czech Republic, flows through Hamburg, and empties in the North Sea. The Weser River begins in central Germany, flows through Bremen and Bremerhaven before emptying into the North Sea. The Oder and Neisse rivers form the boundary with Poland before emptying into the Baltic Sea. A network of canals called the Mittelland Canal connects the Elbe, Weser, and the Ems.

The climate in Germany is generally temperate, averaging 48 degrees F (9 degrees C). In January the average temperature ranges from 21 to 34 degrees F (-6 to 1 degree C), and in July the average temperature ranges from 61 to 68 degrees F (16 to 20 degrees C).

Winters and summers are wet, cool, and cloudy. The south receives the most precipitation with a yearly average of about 78 in (198 cm), mostly in the form of snow. The central uplands receive an average annual rainfall of 59 in (150 cm), while the northern lowlands receive 28 in (71 cm).

Humans have inhabited what is now Germany for at least 400,000 years, evidenced by the discovery of the *Homo Erectus* species known as the "Heidelberg Man." *Homo sapiens* remains have been traced to about 300,000 years. Between 1800 and 400 B.C.E., the Germanic tribes arose and established their dominance in the region.

The Roman historian Tacitus identified over 60 German tribes. Over the centuries, the Roman Empire kept watch over the Germanic tribes along its borders along the Rhine and the Danube. In 9 B.C.E., the Roman Empire met its worst military defeat at the Battle of Teutoburg Forest when three legions under Publius Varus were annihilated by an alliance of tribes under their leader Hermann. The disaster at Teutoburg Forest cost Rome its provinces east of the Rhine and ended its expansion. The weakness of Rome in the third and fourth centuries allowed the Germanic tribes to encroach into Roman territory in the west. In 476, Romulus Augustulus, the last emperor of the Western Roman Empire, was deposed by the German chieftain Odoacer. By the early Middle Ages, Italy and Western Europe were divided into Germanic kingdoms. The Roman Catholic Church, however became a civilizing influence upon the Germanic conquerors.

The history of medieval Germany is one of failed attempts to create a unified state. The Franks were the first German power that sought to dominate Central Europe. In 768, Charlemagne assumed leadership of the Franks and expanded his domains from the Danish peninsula to the north to the ADRIATIC SEA in the south and from Brittany in the west to the Elbe in the east. On Christmas Day in 800, Pope Leo III crowned Charlemagne Emperor of the Romans. Under Charlemagne, this new empire had the beginnings of a central government but fell under the dissension of his heirs. In 843 under the Treaty of Verdun, Charlemagne's empire was divided among his three grandsons. Charles the Bald inherited the Kingdom of the Franks, which became France. Lothair inherited the imperial title and received a region from the North Sea, which ran through the Rhine River and into Rome. Louis received Francia orientalis, which became Germany.

After centuries of conflict between competing dynasties, the imperial crown passed to the Habsburg



family in 1438, where it remained for the rest of the Holy Roman Empire's existence. The Habsburg rulers of Germany used the Holy Roman Empire, as purely a means to strengthen their family's domains in Austria, rather than to create a unified German state. The Habsburgs reached the apex of their power and prestige when Charles V inherited both the imperial crown, and the crown of Spain, which included its holdings in the Netherlands, Naples, and the Americas. At the same time, Charles V reaped the whirlwind of the Protestant Reformation, as Martin Luther defied the authority of the Roman Catholic Church in 1517. Germany's hopes of unification were dashed in 1555 through the Peace of Augsburg, which left each German ruler to decide the religion of his particular state. Germany and all of Europe became embroiled in religious warfare, culminating in the Thirty Years' War. The war ended with the Treaty of Westphalia, which confirmed the Peace of Augsburg, ensuring the sovereignty of the 300 states of the Holy Roman Empire.

Out of the numerous German principalities arose Prussia, which rivaled with Austria for supremacy. Prussia grew from the traditional electorate of Brandenburg in northeastern Germany with holdings along the Baltic coast. Since the 17th century, the electors of Brandenburg-Prussia strengthened their armies into a well-trained fighting force led by its aristocratic class, known as the Junkers. The Prussian army distinguished itself in wars against Poland and SWEDEN. In 1701, Frederick, the elector of Brandenburg, as proof of his state's rise in fortunes, declared himself the King of Prussia.

In 1740, Frederick II (later, the Great) took advantage of the death of Charles VI and the succession of his daughter, Maria Theresa, by invading the Austrian province of Silesia, inaugurating the War of the Austrian Succession. By the Treaty of Aachen in 1748, Frederick retained Silesia. Maria Theresa launched another war, the Seven Years', to regain Silesia, only to end in defeat. Victory in these two wars assured Prussia of a place among the great powers of Europe. Prussia enhanced its prestige further by taking part in the Polish Partitions between 1772 and 1795.

The French Revolution and the resulting Napoleonic Wars were a turning point in the history of Germany. Prussia and Austria joined Britain and Russia in fighting Napoleon's forces from mastering all Europe and the revolutionary ideas he took with him. The rise of Napoleon fundamentally altered the arrangement of the German states. Accepting political reality, Francis II put an end to the Holy Roman Empire and declared



*Neuschwanstein Castle in Germany reflects the country's merging of old and new into a unified and powerful state.*

himself emperor of Austria. Prussia suffered major defeats at the Battle of Jena in 1807 and lost significant territories in the west and its Polish holdings in the east. In 1813, the German states united against Napoleon and defeated him at the Battle of the Nations, paving the way for his downfall.

The Congress of Vienna in 1815 attempted to restore some of the balance of power that was disrupted by the French Revolution and Napoleon. Even though the Holy Roman Empire was never restored, the German states were reorganized into the German Confederation under Austrian leadership as a result of the diplomacy of Klaus von Metternich. Prussia regained some of its eastern territories and acquired the Rhineland. Prussia again asserted its claim leadership through the creation of the Zollverein, or customs union, which eliminated trade barriers among the German states. Conservative reaction was evident in the Carlsbad Decrees passed in 1819, which forbade student associations and dissent. Legitimacy was the order of the day.

The influence of the French Revolution continued to persist, however. Nationalist movements arose among intellectuals who wished to unite Germany based on language and culture. Liberals wanted a government based on limited government, popular sovereignty, political rights, and freedom and equality for all individuals. In 1848, revolution once more spread throughout Europe. In Frankfurt, a group of intellectuals formed an assembly to envision a unified state that



The Brandenburg Gate in Berlin, Germany, has become a symbol of the 1990 reunification of East and West Germany.

carried those ideals and, with the failure of the Frankfurt Assembly, was Germany's last chance to create a unified democratic state.

What the Frankfurt Assembly could not accomplish through resolutions (the unification of Germany) was made possible through political maneuvering and skillful diplomacy. In 1858, Otto von Bismarck rose as chancellor of Prussia. Between 1864 and 1871, his sole purpose was the strengthening of securing Prussian supremacy within the Confederation. At the conclusion of the Seven Years' War, Bismarck declared an end to the German Confederation and expelled Austria from leadership among the German states. Bismarck consolidated Prussian influence by creating the North German Confederation in 1867, which was a federal entity of northern German states under the leadership of the king of Prussia. The Franco-Prussian War in 1870 resulted from Bismarck's machinations to incite France into declaring war against Prussia, bringing the southern German states into his fold. By 1871, Prussia had defeated France, and King William I of Prussia was declared Emperor of Germany, with Bismarck as his chancellor.

The new German Empire was a federal structure that was created by the consent of the princes, rather than the German people. Voting and representation were based on a formula that favored the upper classes. The federal structure overwhelmingly represented Prussia, the largest state in the empire. Between 1871 and 1878 Bismarck launched an unsuccessful campaign against the Catholic Church in Germany, called the *Kulturkampf*, by expelling Catholic religious

orders and imposing a secular educational system. Keeping an eye against revolutionary movements, Bismarck established the beginnings of a welfare state by creating workers' compensation laws and a pension system for retired workers. After unification, German economic productivity rose, outstripping that of its neighbors. In foreign policy, Bismarck sought to assure other European powers that Germany had no territorial or colonial ambitions and sought to live peacefully.

When Emperor William II ascended to the throne, he sought to take Germany on a different course. After dismissing Bismarck, ending his decades of service as chancellor, Germany embarked upon an aggressive foreign policy. Through *Weltpolitik*, or geopolitics, Germany began acquiring colonies and enlarging its navy, which caused great concern for Britain. Bismarck's successors caused Germany to become diplomatically isolated in Europe. By unwisely giving full support to Austria in its dispute with Serbia in 1914, World War I erupted, whose devastating results were unforeseen. After four years of trench warfare and the deprivations imposed by the British blockade, Germany erupted into revolution. William II abdicated and fled to Holland in 1918.

The Weimar Republic replaced the monarchy in 1918 and sued for an armistice. The Treaty of Versailles, which ended World War I, imposed harsh penalties for Germany. The treaty stripped Germany of territory as well as its colonies, imposed occupation in the Rhineland, abolished its navy, imposed restrictions on its army, and imposed enormous reparations, which severely devalued its currency. The German people viewed the Weimar Republic as complicit in Germany's degradation. In the early 1920s, Germany was caught in the struggles between the communists and radical right-wing forces in their battles for control. Economic stability returned in 1925 but was shattered in 1929 with the coming of the Great Depression, bring Germany to a dark chapter in its history.

In 1933, after unsuccessful attempts by succeeding governments to solve Germany's economic woes, 37 percent of the voters elected the National Socialist Party into the Reichstag. Adolf Hitler, a former German corporal and rising star of the Nazis, was invited to become chancellor of Germany by conservatives who sought to take advantage of his growing popularity. Hitler began consolidating his grip on the German government through taking on emergency powers after the Reichstag fire, which was blamed on the Communists. The Enabling Act gave the Nazis full power and eliminated all political opposition. Hitler then turned

on the Jews, whom he blamed for Germany's ills, by eliminating them from government positions. The Nuremberg Laws passed in 1934 removed Jews from German economic and social spheres.

In 1936, Hitler began the territorial aggrandizement of Germany by reoccupying the Rhineland. In 1938, the Anschluss of Austria was achieved, uniting the two German-speaking countries. Hitler succeeded in the dismemberment of Czechoslovakia without Allied opposition. In 1939, Germany invaded Poland, setting off World War II. In less than two years, Germany conquered most of Europe. While simultaneously prosecuting a war against the Allies, Hitler and the Nazis carried forward the Final Solution and attempted to eradicate all European Jews by constructing concentration camps throughout Europe. By the end of the war, the Nazis had murdered 6 million Jews, including Poles, Gypsies, and other minorities. World War II ended with Germany's defeat and occupation by the United States, Britain, France, and the Soviet Union.

In 1949, two German states arose. The Federal Republic of Germany was composed of American, British, and French sectors in the west, and the German Democratic Republic consisted of the Soviet sector in the east. The city of Berlin remained occupied by the four Allied countries until 1994. West Germany was a capitalist democratic state whose economy recovered in the immediate postwar years. Bonn served as the capital of West Germany until a decision could be reached regarding reunification.

East Germany, with its capital in East Berlin, was a bulwark of communism that had shut its borders with the West by the 1960s. Berlin remained the source of Cold War tensions between the Soviet Union and the West. By the 1970s, West Germany began the policy of *Ostpolitik*, which opened relations with East Germany and Eastern Europe. In 1989, with reforms in the Soviet Union and growing popular discontent, the Iron Curtain came down with the dismantling of the Berlin Wall and the opening of borders. By 1990, east and west were reunified within the Federal Republic of Germany. Since then, the costs of reunification have been enormous in bringing eastern Germany to Western standards, engendering discontent. In 1999, Germany moved its capital from Bonn to Berlin and joined eleven other countries in the EUROPEAN UNION in adopting the euro as the unified currency.

Though initially joining with the United States in solidarity after the attacks in New York and near Washington, D.C., on September 11, 2001, Germany

opposed the American and British invasion of Iraq in 2003.

Germany has the third largest economy in the world after the United States and Japan. Throughout the postwar period West Germany has instituted a generous welfare state that shares its wealth with its citizens. However, the costs of reunification and the rise of its aging population have put pressure on the German government to cut back on its benefits.

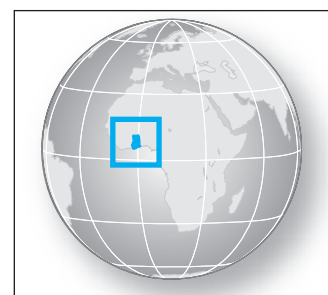
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## Ghana

**Map Page** 1113 **Area** 92,090 square mi (238,500 square km) **Population** 20,467,747 **Capital** Accra **Highest Point** 2,904 ft (885 m) **Lowest Point** 0 m **GDP per capita** \$280 **Primary Natural Resources** gold, bauxite, diamonds, hydropower.



GHANA IS LOCATED in west-central Africa and is bordered by CÔTE D'IVOIRE to the west, TOGO to the east, and BURKINA FASO to the north. The Gulf of Guinea of the ATLANTIC OCEAN washes Ghana's southern shore. Ghana, formerly called the Gold Coast, was a British colony until March 6, 1957, when it gained independence. A country slightly smaller than the state of OREGON, it became the first nation in sub-Saharan Africa to gain political independence from a European colonial power. A densely populated and lowland country, its main export was the production of cocoa, with a little mining, at independence. It supplied the



chocolate industries in Europe with their important raw material, cocoa. It assumed the name Ghana at independence and began to play an important role in African struggle for independence and national liberation.

Flat plains and gently rolling hills characterize Ghana. Its forests cover 28 percent of the country's area, while 26 percent is farmed. The country is divided into five distinct geographical regions. Coastal plains stretch across the southern portion of the country, featuring low sandy beaches interspersed with salt-water lagoons. A forested plateau region consisting of the Ashanti uplands and the Kwahu Plateau is located inland, in southwest and south central Ghana. The hilly Akwapim-Togo Ranges run north to south along the country's eastern border. While the Volta Basin takes up most of central Ghana, high plains characterize the northern third of the country. Its main river is the Volta, which is formed in the center of the country by the confluence of the Black Volta and the White Volta.

The Volta enters the Gulf of Guinea at Ada in southeastern Ghana. The construction of the Akosombo dam in 1961 on the Volta formed Lake Volta. The lake covers an area of 3,275 sq mi (8,482 sq km), making it one of the world's largest artificial lakes. The two major tributaries of the Volta are the Oti and Afram rivers. Together, the rivers drain the Volta Basin. Ghana's other significant river systems are the Densu, Birim, Pra, and Ankobra. All empty into the Gulf of Guinea. Ghana's rivers are navigable only by small crafts, with the exception of the Volta.

Southern Ghana contains evergreen and semi-deciduous forests, consisting of tall silk cottons, kolas, and valuable West African hardwoods such as mahogany, odum, and ebony. About two-thirds of the country is covered by savanna characterized by shea trees, acacias, and baobabs. Oil palm is found throughout the south and the Ashanti uplands, and the lagoons of the coast contain mangroves. Once plentiful throughout the savanna, large mammals such as elephants and lions are now rare and largely confined to nature reserves. The forest regions are habitats for monkeys, snakes, and antelopes. Some of its major rivers contain crocodiles. There are more than 725 bird species in Ghana.

Ghana is a tropical country with distinctive wet and dry climate seasons (with regional variations). The north experiences one long rainy season from March until November, when a hot, Saharan wind known as the harmattan blows from the north and brings the dry

season. The south experiences two rainy seasons: one from April to July, and then—after intermittent rains in August—another from September to November. The northern part, like in Nigeria, is drier than the south, with the exception of the coastal area around Accra.

Despite continuous migration into urban areas, 64 percent of the population still resides in rural communities. The main occupations in the rural areas are farming, herding, and fishing. In the cities, most people work in the service sector or in manufacturing. The country's major cities are Accra, the national capital; Kumasi, the principal city of the Ashanti region; Tema, an industrial city and Ghana's major port; Sekondi and Takoradi, the coastal twin cities; Tamale, a northern trade center; and the college town of Cape Coast.

Upon independence in 1957, Kwame Nkrumah tried a socialist economic reform without success. Ghana, like most developing countries, has witnessed many military interventions, which invariably hampered development. As such, it experienced severe economic decline as a result of political instability. By the mid-1980s, however, economic recovery programs were put in place to encourage and expand private sector investments and more important, to satisfy both the International Monetary Fund and the World Bank reform programs. Since the mid-1980s the government has promoted industries using local raw materials and private investment in food production. Since 1990, Ghana's economy has grown at an average of 4.2 percent each year.

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## Gibraltar

GIBRALTAR IS AN overseas territory of the UNITED KINGDOM. Historically known as one of the Pillars of Hercules, the Rock of Gibraltar has guarded the entrance to the Mediterranean world since the beginning of Western civilization. Held by Great Britain since 1704 (formally since 1713), the peninsula remains one



of Britain's last overseas territories, with little indication of change in the near future, despite intense pressure by the Spanish government.

The Rock is situated at the end of a peninsula, 2.8 mi (4.4 km) in length, that juts out into the Alborán Sea (the westernmost extension of the MEDITERRANEAN SEA), terminating in Europa Point. The other "pillar," Cape Ceuta (or Punta Almina), lies 9 mi (14.5 km) across the Strait of Gibraltar, on the north coast of Africa. To the west are the more protected waters of the Bay of Algeciras, and the man-made Gibraltar Harbor, around which rises the military and administrative community of the colony. The eastern face of the rock is much more perpendicular, as are the northern and southern approaches, underlining the defensive importance of the rock, which itself is composed of dense limestone arranged in thick rock beds. Gibraltar is connected to the mainland of Spain by a narrow isthmus, low and sandy, across which daily migrants travel from the nearby Spanish town of La Línea.

The Rock has been extensively fortified and modified over the centuries, with about 10 mi (16 km) of tunnels, casements for heavy artillery (especially during World War II), a canal cut across the isthmus, and even a narrow landing strip jutting into the Bay of Algeciras on the western side of the peninsula. The naval harbor and dockyard has recently been expanded with a land reclamation project called the Europort, increasing Gibraltar's total land area by 10 percent.

Having no flat land of any consequence, Gibraltar must import all of its food needs. The colony's economy depends instead on tourism, offshore banking and finance, and industries related to shipping.

## HISTORY OF THE ROCK

The Rock received its present name from Arab conquerors in the 8th century, who named it the Rock of Tariq (gebel al Tariq), after one of their generals, Tariq ibn-Ziyad. It was taken by Spanish forces of the Reconquista in 1462 and fortified by Carlos I (Emperor Charles V) using the most advanced German engineers. Occupied by a combined Anglo-Dutch naval force in 1704, during the War of Spanish Succession, Gibraltar was formally ceded to Britain in 1713. Britain maintained its garrison throughout the 18th century, despite repeated Spanish attacks, notably the famous four-year siege during the American Revolutionary War, and Gibraltar was formally declared a crown colony in 1830. Despite attacks from the air by both German and Italian airplanes in World War II, General Dwight Eisenhower kept his headquarters there during the Al-

lied invasion of North Africa. A referendum in 1967 left no doubt that the colony's residents wished to remain British subjects, as a fully self-governing dependent territory. A scheme for "total shared sovereignty" proposed by the Spanish government received a similar overwhelming "no" in a vote held in 2002.

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## glaciation

THE ACTION OF GLACIERS has made a huge difference in the appearance of the Earth's surface. Changes in the land from the action of glaciers is called glaciation. A glacier is a moving mass of ice, air, water, rock and sediment. Glaciers flow very slowly with gravity created by their own mass. During the last Ice Age, more than 19 million sq mi (50 million sq km) of the Earth's surface was influenced by glaciers. Glaciers form when snow builds up over a period of many years. If there is more accumulation than melting, a glacier will form. The weight of the snow compresses the lowest layers, changing the snow to ice. The ice eventually becomes thick enough to begin moving under the pressure of its own weight.

A glacier always moves in the same direction. The leading edge of the glacier is known as the terminus, the nose, or the snout. When a glacier retreats, it does not move backward. The terminus retreats because the glacier is melting at a faster rate than it is moving.

There are several types of glaciers. Ice sheets are enormous masses of ice that cover all land features except the tops of the highest mountains. They are found only in ANTARCTICA and GREENLAND. Ice shelves extend over the sea and surround the entire continent of ANTARCTICA. Ice caps are miniature ice sheets in polar and subpolar regions. Mountain glaciers develop in high mountains and flow down. They are found in CANADA, ALASKA, in the ANDES of South America, the HIMALAYAS of Asia, and in Antarctica. Valley glaciers originate from mountain glaciers. They fill the valley, often flowing to the sea. Piedmont glaciers happen when valley glaciers spill over onto flat plains and spread out. Cirque glaciers occupy bowl-like hollows

called cirques. They are usually found high on mountainsides. Hanging glaciers cling to the steep sides of mountains. They often cause avalanches in the ALPS. Tidewater glaciers are those valley glaciers that reach out into the sea. There calving occurs, which means pieces of ice break off and float in the water.

Glaciers can change the landscape in two ways. They can cause erosional landforms or depositional landforms. Erosional landforms can be created in two ways—by scouring or plucking. When rock and sediment frozen into the bottom surface of the glacier scrapes or scours the Earth's surface, it works like sandpaper. Striations, also known as glacial grooves, are deep scratches carved into the surface of the rock. Plucking removes material from the surface of the earth. It has more effect when there is loose material on the surface. The two processes sometimes overlap.

Glaciers can cause cirques, which are scoop-shaped bowls. Cirques sometimes fill with water, forming lakes known as tarns. U-shaped valleys form when glaciers widen already-existing valleys. Glacial basins are formed where thick, fast-moving warm ice excavates hollows in bedrock. A hanging valley forms when a small tributary glacier erodes a valley so the elevation of the valley floor is higher than that of the valley of the main river of ice. It often contains a waterfall. Aretes, or steep-sided ridges, are formed by two glaciers eroding opposite sides of a ridge.

Depositional landforms are formed when the glacier deposits rock, soil, and other materials. A moraine is an example of a depositional landform. It is an accumulation of materials deposited by glaciers. Moraines usually contain all sizes of particles, ranging from large boulders to fine silt.

There are different types of moraines. An end moraine is made up of material deposited at the snout of the glacier. End moraines are either terminal moraines or recessional moraines. A terminal moraine marks the furthest extent to which the glacier advanced and is found at the lowest elevation. A recessional moraine forms as a glacier pauses during a period of retreat. It is usually located at a higher elevation. A lateral moraine is built up along the sides of an alpine glacier. A medial moraine can form where two glaciers flow together. A till plain, a relatively large, flat plain, is formed when a sheet of ice separates from the main body of the glacier and melts in place.

Any sediment it contains is dropped, so till plains can contain large boulders. When a glacier retreats, hill-shaped deposits known as drumlins occur. A drumlin is shaped like the bowl of a spoon, with the narrow

end pointing to the general direction in which the glacier retreated.

Most glaciation has occurred during an Ice Age. There have been several Ice Ages throughout history, but the most recent began in the Northern Hemisphere about 2.5 million years ago. Climatic changes bring about an Ice Age, when temperatures become cooler. Other factors that can contribute to an Ice Age include tectonic activity, or changes within the Earth, including movement of land masses and volcanic eruptions. The angle at which the sun's rays strike the Earth also has to be taken into account.

Scientists believe we may be living in an interglacial interval within an Ice Age. Over 75 percent of the Earth's water is frozen. Areas with large glacial sheets include Antarctica and GREENLAND. Here huge ice sheets cover all land but the tips of the highest mountains. The Greenland Ice Sheet is growing smaller because of a gradual rise of temperature in that area in the past 100 years. Glaciers also exist in areas considered warm. In the mountainous areas of the northwestern UNITED STATES, NEW ZEALAND, and CHILE, there are large valley glacial systems. These glaciers will survive as long as the accumulation of snow exceeds the melting of the ice. Glaciers in temperate climates like this receive a large amount of snow in winter, which compensates for the fact that melting does occur in summer. If all the world's glaciers suddenly melted, there would be catastrophic results. Florida would consist of a few tiny islands. Many of the world's largest seaports would be underwater.

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## global warming

GLOBAL WARMING IS an increase in the temperature of the Earth due to an increase in greenhouse gases that reduce natural cooling. Periodically, the natural changes in the Earth's climate have produced increases

and decreases in average temperature and the changes have altered the climate of the Earth. The current debate over global warming centers around the likelihood that industrial greenhouse gases are triggering global warming outside the Earth's natural cycle. The debate is both scientific and political, and the consequences are economic, social, and ecological. For example, during the presidential debates of 2000, candidate George W. Bush indicated that the scientific evidence for global warming was inconclusive at best, and that conclusions still needed to be established. As president in the summer of 2001, he withdrew the UNITED STATES from the Kyoto Protocol, an international agreement seeking national limits on greenhouses gases. Then he asked the National Academy of Sciences to examine the science of climate change. The academy reported in 2002 that industrial factors were, in fact, altering the climate.

### EVIDENCE FOR GLOBAL WARMING

Since around 1900, the Earth's temperature has risen about 1.1 degrees F (0.6 degrees C). The increase over the final 40 years of the 20th century was almost half of the total rise over a century. The rate of warming was greater than at any period in the preceding 400-600 years. The 1990s experienced 7 of the 10 warmest years of the century, including the hottest year—1998—since record keeping began over a century before. Mountain glaciers were receding, the Arctic ice pack decreased 40 percent in four decades, and sea levels rose during the previous century at a rate three times as fast as the rates of the preceding 3,000 years. Animals and plants were altering their ranges and behavior. Extreme weather (drought and storms and floods) became more prevalent and more extreme.

The Intergovernmental Panel on Climate Change reported in 2001 that regional climate changes, especially rising temperatures, had already begun to affect many parts of the world. Freezes came later in the year, permafrost was melting, and rivers and lakes were thawing earlier. Growing seasons increased in the mid-to high latitudes as plant and animal ranges shifted poleward and upward and animals and plants changed mating times. The panel's report rested on the examination of long-term studies, normally 20 years or more. The studies consistently confirmed the models. The study rejected chance as a cause in the direction of change, but it did not discount as a reason for magnitude.

The projected impacts, as warming continues, varies by REGION. Ocean and sea levels continue to rise,

heat waves and droughts become more common. as does conflict over water, weather such as floods is more severe, and heat-related illnesses and death and insect- and rodent-borne infectious diseases spread to areas previously without them. Greenhouse gases also damage the world's forests, increasing the amount of carbon dioxide as the forests cleanse less. Some of the measures to counter the emission of carbon dioxide, methane, and nitrous oxides include cleaner cars, alternative fuels, renewable energy sources, and an end to clear-cutting.

### SKEPTICISM AND DEBATE

Richard S. Lindzen, Alfred P. Sloan Professor of Meteorology at the Massachusetts Institute of Technology, says that there seems to be a consensus among the informed populace that global warming is real, as indicated by the upsurge in diplomatic activity. He acknowledges that greenhouse gases have increased, with carbon dioxide increasing 50 percent over the past century; he does challenge the implications and assumptions. He contends that there is little scientific evidence for the popular scenarios of catastrophe. In fact, the literature from hydrologists, economists, and agronomists indicates that adjustments would be fairly simple.

He grants that carbon dioxide levels have risen since 1800, based on evidence from ice cores and atmospheric sampling. The rate has slowed since the 1970s though. And the future depends on human choice—increased use of coal could cause a doubling by 2030. The solution is technology, and Lindzen advocates better nuclear reactors.

After all, the surface temperature has fluctuated within that one degree for billions of years. And the Earth has long had periods with higher carbon dioxide levels than the dire predictions forecast for the coming centuries. A skeptic's history of global warming acknowledges that 19th-century studies did note the possibility of industrial gases increasing warming. But the methodological problems were also noted. And climatologists discounted the theory. In fact, cooling in the 1950s and 1960s caused a concern in the 1970s that the world could be entering a period of cooling, not the warming of the 1980s and 1990s.

Mostly, the crisis of cooling passed with little political or scientific interest. Rising temperatures ended the hysteria. The Geophysical Fluid Dynamics Laboratory at Princeton and other institutions continued to model change and predict warming, but it remained an academic exercise until 1988. In the summer of 1988,

James Hansen of the Goddard Institute for Space Studies testified before the Senate Committee on Science, Technology and Space, saying that he was sure that temperatures had risen and greenhouse warming was occurring. It was a warm summer, and temperatures had risen in the 1970s faster than an even increase in carbon dioxide would warrant. Hansen cited no cause and effect relationship. Initially the climate-modeling experts criticized Hansen for trying to use shaky modeled data as the basis for public policy. Still, the community acknowledged that the warming model wasn't impossible.

Environmental groups seized on Hansen's testimony, making "global warming" a battle cry, a marketing tool. The Green lobby in the United States soon had a budget of several hundred million dollars and 50,000 employees. The media went along because the Green catchphrases were easier to understand and sold more papers than the abstruse technical debate. For the Greens, the burden of proof was absolute. They construed the scientific inability to disprove warming as validation of their nightmare scenarios. And scientists other than Hansen supported the model by acknowledging that increasing carbon dioxide probably would cause warming, but most remained skeptical about huge amounts and huge impacts. Politicians joined the effort, as did performers and other media personalities. The media in Europe and the United States by 1989 were declaring a scientific consensus.

As the movement grew, with politicians and others clamoring for saving Mother Earth, more skeptical scientists attempted to redress the balance. Reports in *Forbes* and *Reader's Digest* indicated that there really wasn't the scientific consensus the advocacy groups professed. The *Bulletin of the American Meteorological Society's* series supporting the environmentalists generated counterarguments from skeptics. A Gallup poll of climate scientists in the American Meteorological Society and in the American Geophysical Union indicated that 49 percent doubted man-made warming data, 18 percent accepted that some had occurred, and a third didn't know.

The warming advocates countered. A geologist at Greenpeace, Jeremy Legett, attacked the critics. Popular writings proliferated. George Mitchell, Senate majority leader and father of a prominent environmental activist, produced *World on Fire: Saving an Endangered Earth*; Senator Al Gore wrote *Earth in the Balance: Ecology and the Human Spirit*. The Union of Concerned Scientists, originally a nuclear disarmament group, then a nuclear power opponent, turned to the

global warming issue. Its petition citing global warming as the greatest risk to humanity got 700 signers, including members of the National Academy of Sciences and Nobel laureates. Most were not climatologists. And the petition called for renewed work on nuclear power.

Skepticism increased among the scientists even as consensus grew among the environmentalists and politicians kept the bandwagon rolling, reiterating the claims of scientific unanimity.

### SCIENTIFIC DOWNSIDE

The downside of making a political issue out of science is that it weakens the science in question. Funding for climate research actually decreased as the growth of researchers and programs was faster than the growth in funding. And one string attached was that the research must have the right result. Government money and government power were tied to one side of the debate. And industry got onto the bandwagon, especially industries that stood to profit by enhancing their image as environmentally responsible or industries such as waste management companies that had a direct economic benefit. Utilities could broaden the base on which they got profits. And environmental improvement was a \$1.7-trillion-a-decade enterprise.

As a final note, the whole question of modeling is confused by the tendency of many to believe that the great increases in computing power over the past decade or so have allowed the models to be accurate. The experts know that the complexity of the system is such that even this great computing capacity is insufficient to even approximate an accurate model. Without a good model, there is no solid basis for any conclusion. Just a vast waste of resources that could be better employed elsewhere.

### THE KYOTO PROTOCOL

In December 1997, more than 150 nations signed the first legally binding treaty aimed at cutting emissions of the main greenhouse gases believed to contribute to global warming. The meeting in Kyoto, JAPAN, though, left much of the detail about how it would be implemented to future talks. These dragged on, reaching a crisis in The Hague, NETHERLANDS, in November 2000 when the United States and the EUROPEAN UNION failed to agree and talks broke down. President Bush soon afterward announced that he was pulling the United States out of the deal altogether. Since America produced a quarter of greenhouse gases, that was a big blow, but the other nations decided to carry on, and



they finally reached agreement in Marrakech, MOROCCO, in November 2001.

Under the terms of the protocol, industrialized nations committed themselves to a range of targets to reduce emissions between 1990, the base year, and 2010. The world targets ranged from an average 8 percent cut for most of Europe up to a 10 percent increase for ICELAND and an 8 percent increase for AUSTRALIA. (The United States originally committed itself to a 7 percent cut.) The members of the European Union agreed to parcel out their entitlement so that countries such as IRELAND and GREECE could increase their emissions, while Britain, GERMANY, and others faced cutbacks.

Global warming is a highly charged political and economic issue. Third-world and developing nations contended that only the developed nations were in a position to afford reforms and technology; developing nations were not. Besides, the developed nations generated most of the gases and were the beneficiaries. Why should developing nations be penalized for following the industrialization path that brought wealth to the developed ones? Industrialized nations argued that the controls would be futile unless all nations cut back, even the developing ones. The United States contended that unequal standards would give developing nations a trade advantage. Domestic companies might desert the United States for countries without limits. Developing nations did win their demand for an exemption. The U.S. Senate voted 95–0 not to ratify any treaty that would not apply the same standards to all signatories.

### THE TIPPING POINT

In 2004, the U.S. Department of Defense jumped onto the global warming bandwagon. It reported evidence that the ocean-atmosphere system that determines the world climate, rather than shifting gradually over long periods of time, had historically moved quickly, within a decade or less, from one condition to another. The question for the department became how close the climate system might be to the threshold of another rapid shift. The explanation was that the current that brings tropical water and warm air to northern Europe and the eastern United States might be diluting because of increased cold water as glaciers melt and alter the ocean's salinity. Potentially, the current could collapse.

Earlier global warming, not caused by human impacts of course, replicated the human industrial centuries. As the Ice Age ended 13,000 years before, Greenland began warming, the current apparently shut down, and a mini Ice Age ensued, lasting 1,300 years. That was the Younger Dryas period.

Although the Younger Dryas ice age was natural, the climatologists in 2001 were more inclined to attribute similar conditions during the previous half century of global warming to human influence. They cited shrinking Arctic ice, melting glaciers in the ALPS, earlier springs in northern regions. They attributed these to the burning of fossil fuels (coal and petroleum), which releases heat-trapping carbon dioxide. When the climate experts met in 2001, they were worried about the consequences for future generations. Then came the tipping point theory. At some point in a process, the threshold is reached, and gradual change tips abruptly in the new direction.

### THE DAY AFTER TOMORROW

The National Academy of Sciences in 2002 reported that human activity could be the trigger of a new ice age from global warming. At the World Economic Forum at Davos, Switzerland, in 2003, Robert Gagosian of the Woods Hole Oceanographic Institution in Massachusetts strongly encouraged examination of the implications of a tipping point that could occur within two decades. Others alarmed at the possibility included billionaire Gary Comer of Land's End, who made climate change one of his philanthropies. In Hollywood, 20th Century Fox was preparing to release *The Day After Tomorrow*, a disaster movie set in the Ice Age caused by global warming. Not all scientists agreed, of course, but the momentum was shifting; even the cautious Department of Defense discerned a real threat from global warming.

While the scientists disputed with each other, the Pentagon defined climate change as a national security threat that could arrive as early as 2020. Megadroughts, nuclear war, mass starvation—these were some of the consequences of wars for river valleys and other sources of water and food. Once past the tipping point, change could occur within three to five years, bringing on another ice age. The Pentagon ceded that the probability of such consequences is unknown, probably quite small, but the risk is so severe that there is no option of assuming that it's a myth or bad science.

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## globalization

**GLOBALIZATION** IS A term that is used quite frequently but whose meaning remains obscure. One definition of globalization is that is a process of complex interconnections between societies, cultures, institutions, and individuals that takes place worldwide. It also describes the increased mobility of goods, services, labor, technology, and capital. Although globalization is not a new development, it has rapidly increased with the introduction of new technologies. Globalization is often referred to as a contemporary or modern phenomenon, but it can also be studied from a historical perspective; the result of human innovation and technological progress (biotechnologies, miniaturization, digitalization, and photonics). These activities represent more than just the simple globalization of economic activity; they refer to the increasing integration of economies and societies across the world. Unfortunately, not everyone is represented equally in the globalization process as it is affected by wealth, access to global communication media, work, financial assets, and cultural norms.

Therefore, the processes of globalization have been reshaping the geography of the global economy. Globalization is a process in which geographic distances become less a factor in the sustaining of rigid land borders, long-distance economics, and political and socio-cultural relationships. Networks of relationships and cooperation cross land borders and oceans and occur worldwide. As globalization grows, geographic distance is less of a factor as the Earth does not really shrink, but "relative" distances do. Therefore, worldwide networks of agreements/cooperation can be established.

The transformative ability of the globalization process has commonly been associated with both material outcomes in such specific spatial units as locali-

ties, regions, and nation-states and peculiar discursive practices by societal partners. At the opposite, many researchers consider that globalization is associated with the declining influence of space in relationships among societies.

The debate on the ideology of globalization can be categorized into four different areas: 1) Free trade globalization is a way to enhance prosperity; 2) the adverse view: the potential dangers of globalization include increasing inequalities, marginalization of some regions or countries, social exclusion, crisis tendencies and simultaneous loss of political control; 3) globalization is thought of as a myth since the theory is not justified by the actual development; and 4) lastly, some economists view globalization as nothing new, as economic affiliation is as intense today as it was before World War I, 100 years ago.

Globalization can also be thought of as an ideology. The slogan of globalization is "Either globalize or perish." As an ideology, globalization implies both the inevitability and the desirability of the tendency toward integration, and not the adverse. On one hand, globalization has been accepted as the unavoidable pathway to economic prosperity and success. If a national country's economy is not performing well, it must be because the economy does not have "enough" economic globalization. On the other hand, anti-globalization views economic globalization as the cause of socioeconomic malaise.

### EMBEDDED AND DISEMBEDDED CAPITALISM

Finance and transnational corporations are the core subjects of economic geography. Any viable geography of finance must have something credible to say about market patterns and processes. The power exerted by finance is represented by the growing role of capital markets in the globalization processes (the rise and spread of institutional investors). The national specificity of capital markets explains why there is not a truly global capital market.

To some people, globalization means the ability of transnational corporations, through the use of free trade agreements and free trade zones, to transform space. Financial liberalization enhances capital mobility and shapes global values. In this view, transnational corporations attempt to dominate the world through the eradication of governmental controls and the homogenization of economies for their own profits, while marginalizing the rest.

The expansion of the role of transnational corporations through the mechanism of foreign direct invest-

ment in the world economy is the driving force behind globalization. Furthermore, globalization increases the access to global resources for a small corporate elite. Globalization means the concentration of power and wealth in the few hands of multinational corporations whose only mandate is profit (shareholder value creation). As a result, this leads to disempowerment of civil society and the homogenization of culture worldwide.

From a cultural perspective, there are two positions taken for and against the phenomenon of globalization. It is thought that globalization will lead to a homogenization of culture as people around the world will devalue their local culture and adopt American or Westernized ways. However, the goal of globalization is not that the entire world would become Westernized and capitalist, but that the Western culture becomes the standard by which other cultures measure themselves.

Critics of globalization suggest that globalization is a self-propelling social dynamic; others argue this is not true. In reality, the economic sphere is directed by the World Trade Organization (WTO) with its underlying goal of economic equality in political and cultural influence, through the powerful means of information technology, dominated by the West. The weak cultures may not be able to resist forces of globalization, but third world countries should not be unaware of the “hidden agenda” of globalization. It is argued that the transnational class of elite export a set of values consistent with the American ideology of liberalism and capitalism.

This view argues that globalization is a new form of activity in which a society moves from industrial capitalism to a postindustrial idea of economic relationships. This change is driven by a revolution among the techno-industrial elite that will eventually consolidate into a single global market. Recently, the information technology revolution has opened up new possibilities of communications and monitoring abilities across long distances, and has made it easier for transnational corporations to outsource some parts of their business.

There is a widening structural differentiation of goods and services that have spread influence across traditional political borders and economic sectors, and it has resulted in the greater influence of political and economic changes. These changes have transnational and multinational dynamics that are a major influence on outcomes in determining “issue-areas” (for instance, environment, trade, and world regulation) and

may encourage global and local companies to be more autonomous from a traditionally exclusive government decision-making and policy. Globalization can also be considered as the result of a larger building process of the world market.

Nevertheless, globalization is neither uniform nor homogeneous. There is a marked difference between the degree of globalization as reflected in trade, foreign direct investment (FDI), and international finance. Its boundaries are unclear and its constituent elements and multidimensional character have yet to be adequately explored. Some scientists have considered globalization as a first step to complex interdependence, which accepts the notion of transnational interpenetration. Other experts contend that globalization modifies deeply the structural framework of rational choice in world relations, since the role of the key factor that commonly defines both international and domestic relations (that is, the government) is subject to a critical structural transformation. The government commonly faces crises of both organizational efficiency toward the consumer and institutional legitimacy toward the citizen.

Therefore, there is a need to understand and propose new governance structures and mechanisms at the global and local levels, encompassing political and social needs of the government, social movements, non-governmental organizations (NGOs), grassroots movements, the media, transnationals, organized citizens, the science community, and religious movements.

### IMPORTANCE OF PLACE IN GLOBALIZATION

Historically, economic activity has been tied to geographic location. This relationship emerged around 1000 C.E., as political-military organization (empires, monarchies) absorbed autonomous cities that were the centers of economic activity in their geographic territory. The geographic merger of military and economic activities was transformed into a modern global interstate system that demarcates the physical boundaries of the world today.

To understand economic geography is to see the world as a mosaic of regions. Many researchers associate globalization with deterritorialization, where a variety of socioeconomic activities take place irrespective of the geographical location of the individuals or activities. One of the paradoxes addressed by researchers is why there has been a growth of dynamic local economies at a time when places are increasingly under the influence of, and threat of competition from, distant places—threats that are a consequence of the glob-

alization of the markets. One of the possible answers to this question is that local technological dynamism depends on local non-tradable assets such as trust or social capital. Does one refer to geography as preexisting spatial configurations that simply do not wither away in the midst of globalization processes? Or perhaps more significant, what is the explanatory relationship between geography and globalization? Is geography simply an outcome of globalization that poses as the cause? How does geography matter in our explanations of globalization? This last question points to a significant inversion of cause (geography) and outcome (globalization).

On the other hand, many of the contemporary views on trade theory and international economics predict that globalization will lead to more intra-industry specialization because of locational concentration. Territory, in the sense of a traditional sense of a geographically identifiable location, no longer constitutes the whole.

The rise of globalization seeks to capture the two-way interaction of global processes and local conditions to generate new adaptations. Globalization is associated with the production of new scales in economic and political space. It enhances the importance of supra-national and subnational scale processes. In particular, it underlies the arguments of a number of economic geographers that localized agglomerations of economic activity are a product of globalization. While this may be shown at the local level within the nation-state, it may also be argued at a more macro-level in such a regional formation as the EUROPEAN UNION (EU), seeking to define a "European identity" for its member states in a new global era. The hegemony of neo-liberal ideology is about the triumph of market-oriented ideology, the economization of life, mass consumption and entertainment, deregulation, and so on. It is a global ideological breakthrough in which democracy is considered to be a twin of the market economy, and these together are supported to form a winning team.

Frequently, it is theorized that economic globalization leads to deepening income inequality and unemployment. Similarly, debates on the winners and losers of economic globalization have also demonized globalization as a mythical juggernaut that is powerful enough to cause all sorts of socioeconomic miseries and political problems. More specifically, the intrinsic spatiality of economic globalization sets some necessary, but not sufficient, preconditions for it to effect empirical changes and outcomes. To define the spatiality of economic globalization, we have to look into

specific geographic foundations that presuppose and legitimize economic globalization: the transcendence and switchability of geographic scales and discursive practices as socio-spatial constructions. When coupled with other substantive political-economic forces, these geographic preconditions—not economic globalization *per se*—help to explain empirical consequences and outcomes.

Additionally, economic globalization represents a major transformation in the territory of key economic sectors. To what extent it also represents a possible transformation in the structures of politicoeconomic power is a difficult question. The major dynamics at work in the global economy contain the capacity to undo the interaction of sovereignty and territory embedded in the modern state system. This does not necessarily mean that sovereignty is less of a feature under conditions of globalization. Rather, it may signal the relocation of some components of state sovereignty onto supranational authorities. Similarly, economic globalization does not eliminate the government's exclusive control over its territory, but alters the particular type of institutional encasing of territory that has developed since World War II.

Globalization is the focus for popular fears about American power, the might of big business, the pace of economic change, and a sense of powerlessness in the face of intangible global forces. The debate is increasingly polarized between market fundamentalists and anticapitalists.

To satisfy short-term institutional investors and inflate the value of their share options, bosses gamble with their companies' future to ramp up the stock price. Unsurprisingly, trust in the financial system has evaporated since the collapse of Enron, Worldcom, Ahold, Parmalat, and others.

## CONCLUSION

The debate over globalization can be broken up into two main camps: the globalists and the skeptics. Globalists claim that globalization is a new transformation of world order and a positive change. They point to the interchanges between cultures, economies, and people. They herald the time-space compression as a seamless means for fixing many of the world's problems.

The skeptics, on the other hand, do not think that globalization is occurring, or if they do, they think it is a negative phenomenon. The skeptics also point to the growing size of state budgets, nationalism, and agreements between countries in regions, all processes that are regional, not global.



Globalization, as a myth, is the belief is that we are witnessing a process of regionalization with competing trade blocs. International economic integration has tended to be a regional rather than a global phenomenon. That is, the linkages among the world's economies have tended to be stronger, within defined geographic regions or blocs, than between those regions. Examples of these groups or blocs would include NAFTA (North American Free Trade Agreement), the EU, and Asian regional organizations. A regional pattern is clearly evident in the data on global trade flows. For the three regions cited above (which together account for about 80 percent of global gross domestic product), intra-regional trade in goods now accounts for 50 percent or more of exports. Also, it is clear that formal regional trade agreements such as NAFTA and the EU potentially foster intraregional trade.

Globalization versus localization suggests that distance matters, irrespective of transportation costs, so that spatial proximity of countries influences sales patterns over and above regional trade liberalization. It also seems clear that borders matter irrespective of distance. Globalization is sometimes credited with or blamed for influencing both domestic economic performance and the capacity of domestic policies to effect changes in that performance.

The power of national governments is reinforced, not weakened. The structural adjustments of the World Bank and IMF (International Monetary Fund), bilateral conditions, rationalization of existing structures, and new regimes under the WTO are factors that aid the globalization process. These processes are closing the policy choices for developing countries, which are losing their options. Developing countries are struggling to cope with the new conditions of development and survival. The process of globalization exacerbates the existing poverty and inequality situations within and among countries. Also, globalization is accompanied by the rising of inequalities within and between countries. Consequently, globalization can expose the internal problems and tensions among the states, societies, transnational corporations, and other global factors. The current agenda will be to delineate the path to achieve sustainable development and minimize the risks.

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## Gobi Desert

THE 650,000-square-mi (1,600,000-square-km) Gobi is the largest desert in CHINA and MONGOLIA; both the Taklamakan Desert (in XINJIANG) and the Changtang Desert (in TIBET and Qinghai) are only half the size. Only the SAHARA is bigger than the Gobi among the world's deserts. The Gobi separates the Republic of Mongolia from the province of Inner Mongolia in the People's Republic of China (PRC). In Mongolia, the Gobi occupies all the southern districts (*aimak*) of the country: eastern Gobi, central Gobi, southern Gobi, Baian Khongor, and Gobi Altai. In China, the Gobi Desert extends from Manchuria to Gansu and Xinjiang. It consists of several plateaus: Hulun Buir, Xilin Gol, and Ulanqab in the east and the Alashan plateau in the west of Inner Mongolia. The Yinshan Mountains and the Hexi corridor form the southern edge of the Gobi Desert.

Although vast, the Gobi peneplain is neither the driest nor the warmest desert in western China. The Siberian high-pressure system keeps the Gobi dry and very cold in winter; in summer, the monsoon winds bring a few inches of precipitation to the region. The meager vegetation and the brief growing season account for the barren appearance of the Gobi. Topographical profiles of Inner Mongolia display a succession of denuded hills covered with *gobi* pebbles and basins covered with sandy *gobi* gravel. *Gobi* or *govi* usually means "desert" in Mongol, although an absolute desert would be

called *tjall* or “waste.” *Gobi* designates also the wind-eroded small basins that are scattered in the desert. Chinese geographers establish a difference between sandy desert (*shamo*) and gravel desert (*gobi*). They call *gobi* the gray surface of hard pebbles that covers dilluvial plains. Sand dunes are indeed rare in the Gobi Desert.

### FORMIDABLE PROTECTION

The Gobi enjoyed a semitropical climate during the Cretaceous period (145 to 160 million years ago). The paleontologist Roy Chapman Andrews organized, in the 1920s, the Central Asiatic expeditions of the American Museum of Natural History. He discovered rich repositories of dinosaur fossils in what is now a forbidding desert, with badlands and salt flats. The two characters in Chinese to transcribe *Gobi* are *ge*, “halberd,” and *bi*, “wall.” Combined, they suggest that this type of desert constitutes either a dangerous obstacle or a formidable protection. No major road crosses the Gobi Desert except for the imperial highway from Kalgan (Zhangjiakou) to Ulaanbator and the much more recent Transmongolian railway that links Beijing and Ulaanbator via Baotou. The Gobi plays today an unexpected role in space-based international communications as the launch site for Chinese Long March rockets; the Jiuquan launch site lies in the western Gobi Desert (Gansu province).

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## Golan Heights

THE GOLAN HEIGHTS (in Arabic, Al-Jaw-lan) is a hilly region in southwest SYRIA, bordering nearby regions of LEBANON and JORDAN, with a highest point of 7,297 ft (2,224 m). The area is one of the most heavily disputed areas in the history of the 20th century. When the state of ISRAEL emerged after the vote of the United Nations and the war of independence in 1948, the Golan Heights, under Syrian rule, were used as a military tactical point against Israel. Up to the war of



The Golan Heights (above, pre-1967) remain a hotspot of international tension between Israel and Syria.

1967, Syria used the Golan Heights to attack Israeli villages from the Sea of Galilee to the Lebanese border with sporadic artillery fire. The Golan Heights were heavily fortified by the Syrians, but the Israelis were informed about these activities by their master spy, Elie Cohen. The Israelis were able to take the Golan Heights in little more than 24 hours during the 1967 war, and the Syrians lost their decisive strategic asset for shelling large parts of northern Israel.

In the war of 1973, the Israelis were taken by surprise, including on the Syrian front. After heavy losses, the Israelis, in an unprecedented turn of the tide, drove out the conquering Syrians and were only stopped by political pressures from the UNITED STATES to go all the

way to DAMASCUS, the Syrian capital. After political negotiations brokered by U.S. Secretary of State Henry Kissinger, Israel and Syria signed a disengagement agreement in 1974. The Israelis gave back the Syrian land conquered in 1973 and even part of the Golan Heights area (especially the city of Kuneitra).

The economic importance of the Golan Heights is negligible (apart from some tourism, including winter sport facilities in the Mount Hermon area), but the strategic importance of the Golan Heights is gigantic. By its prominent position, the Golan Heights can control many parts of northern Israel. Therefore, the Israeli parliament made the Golan Heights part of Israel in 1981. U.S.-brokered negotiations in the 1990s for a peace settlement between Syria and Israel failed, as the Syrian side demanded the return of the Golan Heights before any peace settlement, and the Israeli side ruled out discussions on a change of sovereignty of this strategic asset without any durable peace settlement with Syria. The Golan Heights remain a hotspot of international tension and could well become the setting for another war, although the area has limited immediate military presence as a consequence of the agreements of the 1970s.

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## Grand Canal (China)

THE GRAND CANAL is one of the wonders of the world. Built in the 7th century by CHINA's Sui Dynasty, it stretches about 1,100 mi (1,800 km) across eastern China—about the same distance as MIAMI, FLORIDA, to NEW YORK CITY, or LOS ANGELES, CALIFORNIA, to Vancouver, CANADA. The canal was built to transport rice and silk from the rich and fertile south to the dry and barren north, particularly to soldiers protecting the frontier and the northern capital, BEIJING. Major cities grew up along its route, which remain major commercial centers to this day, although much of the canal is now too small or too full of silt to carry major boat traffic.

The Grand Canal, Da Yunhe in Mandarin Chinese, has been called the “Bridle on the Dragons” since it crossed China's five major east-west rivers and helped control perennial flooding in the region. Throughout China's history, dynasties could rise and fall depending on their ability to control these floods; natural catastrophe was a sign of displeasure from the heavens and frequently led to change in regime. Sections of the canal were built as early as the 4th century B.C.E., though most of it was undertaken in the 7th century C.E. by the notoriously cruel Emperor Yangdi: The forced labor of millions of peasants accomplished a nearly complete canal in only six years. It linked the southern city of Hangzhou to Xi'an (then the largest city in the world), and from there trade passed overland via the SILK ROAD to western Asia and Europe. The canal still begins at Hangzhou, capital of the 13th-century Song Dynasty, which was visited by Marco Polo, who described it as the most magnificent city in the world. When the Mongols (Yuan Dynasty) set up a new capital at Beijing in the next century, the canal was extended further north to feed the capital and its armies with rice from the south.

Heading north from its terminus at Hangzhou, the Grand Canal crosses the provinces of Zhejiang and Jiangsu, where it passes through the city of Suzhou, sister to Hangzhou. Both cities are famous for their gardens and natural beauty (Suzhou is sometimes referred to as the “Venice of the East” because of its extensive canals). The canal forms the main street for commercial cities like Wuxi and Xuzhou, where hundreds of small junks compete for space with larger barges, loading and unloading products—silks, rice, green tea—onto train lines that reach far into the Chinese interior. The canal then intersects the Changjiang (Yangzi River) about the midpoint between two of China's most important cities, Shanghai and Nanjing. Following the contours of the North China Plain, the canal is at its deepest and widest, enough for 600-ton riverboats.

Small rice plots surround the canal for miles. The landscape begins to change as the waterway enters Shandong Province: plaster and tile houses of the south give way to mud and thatch in the north, wheat replaces rice as the dominant crop, and mules replace water buffalo as the major domesticated animal. This region is heavily affected by drought and floods, and much of the region's trade has shifted to railroads, leaving many sections of the canal completely dry, with much of its water used for irrigation. The canal no longer enters the Huang (Yellow) River, which has

risen about 20 ft (6 m) on silt deposits, kept in by dikes. From the Huang River, the canal works its way north through Hebei Province to Tianjin, the port city for Beijing. Formerly connecting Beijing to its port, the canal is now unnavigable between the two cities.

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## Grand Canyon

WITH DIMENSIONS of 277 mi (446 km) long and 18 mi (29 km) wide, the Grand Canyon is one of the most spectacular natural wonders of the world. Crafted by the Colorado River, it is an enduring and unchallenged natural symbol of North America. At its present size of 1,904 square mi (4,911 square km), the Grand Canyon is the fourth-largest park in the lower 48 states of the UNITED STATES.

Formation of the canyon is a relatively recent event, in geologic time. The Grand Canyon is a vast landscape composed of layers upon layers of different kinds of rock that are distinct in color and texture. Basement rocks of black Vishnu schist, hard metamorphic rock, and granite form the inner gorge of the canyon. The Kaibab limestone found on the canyon crest is estimated to be 225 million years old.

River runoffs from the rims have cut hundreds of side canyons, which spread and gradually isolated the buttes and mesas that now tower thousands of feet above the canyon floor. Half of the Earth's history is represented in the rocks at the Grand Canyon. On its walls, four geologic eras are visible in the sedimentary rocks. The fossils in its layers illustrate the evolution of life: Nowhere else in the world has been found a clearer view of geologic processes.

Climate at the canyon varies with the season and altitude. The North Rim, which is 8,000 ft (2,438 m) above sea level, receives so much snow that access by road is cut off to tourists all winter (late October to early May). Between June and August, normal daytime temperatures at the rim rise above 70 degrees F (21 degrees C), while nights remain somewhat cool. The

South Rim, at 7,000 ft (2,134 m) above sea level, is open year-round. At night, the temperature still drops well below freezing between late October and April. Upper portions of hiking trails get dangerously icy. Between May and September daytime temperatures will have highs above 70 degrees F (21 degrees C) at the rim; no matter what the season, it is always much warmer at the bottom of the canyon.

The temperatures in the Inner Canyon, at river level—almost 5,000 feet (1,524 m) below the South Rim—are often in excess of 100 degrees F (38 degrees C) on most days between late May and early September. The temperature at the river is unlikely to drop below 70 degrees F (21 degree C) even at night. Little direct sun reaches the bottom of the canyon, but the bottom of the canyon seldom freezes, and December highs remain well over 50 degrees F (10 degrees C).

Precipitation in the canyon is fairly rare, except for some snow in winter and rain in August, when afternoon thunderstorms sweep in and blow over quite rapidly. The canyon receives 15 in (38 cm) of rainfall in an average year, and at any time during the year the canyon can be invisible beneath a layer of cloud or fog. Despite the fact that Grand Canyon boasts some of the cleanest air in the United States, air pollution from far-away cities, smelters, and neighboring power plants continues to reduce visibility at the Grand Canyon by 30 percent below natural levels. In September 2001, the owners of the Navajo Generating Station made an agreement with the Grand Canyon Trust to reduce sulfur emissions by 90 percent.

The Grand Canyon receives nearly 5 million visitors annually. Thirty percent are foreign tourists. Most come to the South Rim, stay only for a few hours, and use the many observation points to look across and down into the canyon. But to truly experience the Grand Canyon, one must go down in it. To get inside the canyon, tourists can hike down preserved trails or take a mule ride to the bottom of the canyon. Rafting whitewater rapids through the Colorado River is another way to experience the massiveness of the Grand Canyon from within. There are also several campsites inside the canyon for adventurers seeking to enjoy more than a few hours of the experience.

Cascading waterfalls plunge into waiting pools of water on the Havasupai Indian reservation, near the lower end of the canyon. The canyon was home to at least seven Native American tribes, and the Hopi Indians still regard the canyon as their place of emergence onto the Earth and the place where their dead return. Their predecessors left behind more than 3,000 archae-



ological sites and artifacts as old as 10,000 years. Home to 88 species of mammals and 315 species of birds, the Grand Canyon was declared a national monument in 1908, when President Theodore Roosevelt decided to protect it in perpetuity; in 1919 the U.S. Congress authorized the expansion and upgrading of the monument to a national park.

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## grasslands

MANY DIFFERENT TYPES of ecosystems throughout the world are described as grasslands because they are dominated by species of grass with a range of other plant types as subordinates within the community. Grasslands occur at most latitudes and altitudes reflecting the wide range of environmental tolerances that characterize this huge taxonomic group of plants known as the *Gramineae*.

There are approximately 9,000 species within this group. They are described as monocotyledons because there is only one leaf protecting the seed, in contrast to most flowering plants, which have two seed leaves and are known as dicotyledons. Grasses reproduce by generating and dispersing seed; many species spread through the production of underground stems called tillers. These two characteristics have been widely exploited in agricultural systems. First, many species producing particularly carbohydrate-rich seeds have been domesticated, a process begun more than 10,000 years ago, and today they are major cereal crops of arable agriculture, notably rice, maize (corn), wheat, barley, oats, rye, and sorghum. Second, the ability of grasses to produce a turf ground cover through tillering and the placement of the growing points close to the ground facilitates grazing by herbivorous animals and thus underpins pastoral agriculture worldwide.

Broadly, grasslands may be classified as natural, seminatural, and artificial. Each of these groups can be

further subdivided. Natural grasslands are widespread and tend to occur where climatic or soil conditions prohibit the growth of shrubs and trees; annual precipitation regimes are especially influential, as a pronounced dry season or seasons is characteristic of grasslands, along with a low annual precipitation. The occurrence of natural fire may have also played a role in the formation of continental grasslands. Other factors may give rise to grasslands locally, such as persistently cold, high-speed or salt-loaded winds in coastal areas.

### GRASSLAND CATEGORIES

The main categories of natural grasslands are alpine or high mountain grasslands; high-latitude TUNDRA; temperate grasslands such as the prairies of North America; the PAMPAS of South America; the STEPPES of Eurasia; the grassveld of the high PLATEAUS of SOUTH AFRICA; and tropical grasslands such as those of savanna regions. Most are in continental interiors with moist continental or dry subtropical climates. All of these grasslands can be further subdivided. The prairies, for example, comprise the eastern and western prairies that are separated by the ROCKY MOUNTAINS. Moreover, the eastern prairies comprise three communities: tall-grass, mixed-grass, and short-grass prairies, which reflect decreasing precipitation along an east to west gradient. A similar gradation exists in the steppes, where tall-grass communities are known as meadow and short-grass communities as typical steppe. Savanna, by definition, is a vegetation type in which grasses form a continuous ground cover.

However, there may also be trees and shrubs present in various degrees from sparse to abundant. All of these grasslands have been considerably modified by human activity, especially for arable and pastoral agriculture. Indeed, the prairies and steppes are considered to be the "bread basket" of the world because of their production of wheat. Alpine grasslands are exploited for summer feed for animals, for example, yak production in MONGOLIA and cattle production in SWITZERLAND, in a practice known as TRANSHUMANCE.

Seminatural grasslands occur in areas once occupied by trees and shrubs and where some type of human activity has favored the spread of grasses. Grazing and forestry are the most significant causes of this shift. Grazing prohibits the growth of trees and shrubs, as they are eaten by animals, while favoring grasses that can withstand grazing pressure. Forestry, once land has been cleared of trees either in small patches or through clear felling, generates unshaded conditions

avored by grasses. Controlled firing may be a significant component of such management strategies. Consequently, seminatural grasslands exist throughout the world in areas that could and once did support a forest cover. They vary in size from small glades to many hectares and the grass species present reflect local climate and soils as well as the plant community composition of the source areas from which the invaders derived.

Artificial grasslands are so called because they occur in areas that could support trees and shrubs but these are prevented from growing through management. Their floristic composition is manipulated through seeding and dressing with fertilizers and herbicides that favor species with high nutritional value for grazing animals. Such grasslands are common in countries where high-technology agriculture is practiced, especially in the developed world.

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## Great Barrier Reef

THE GREAT BARRIER REEF, located on the northeast coast of AUSTRALIA, is comprised of the world's largest cluster of coral reefs. It is 1,250 mi (2,012 km) long; running along 10 mi (16 km) of the eastern Australia shore in the north to 100 mi (161 km) in the south. Its length is comparable to that of the entire West Coast of the continental UNITED STATES.

The Great Barrier Reef is an example of the key stages in the Earth's continuing ecological and biological evolution of natural phenomena and habitats. The Great Barrier Reef's diversity shows the development of an ECOSYSTEM that has evolved over hundreds of thousands of years. It is the world's most extensive coral reef system and is one of the world's richest areas in terms of plant and animal uniqueness. There is more than just coral to the Great Barrier Reef. It also contains widespread areas of sea grass, mangrove, soft bottom, and island communities. The reef is not a con-

tinuous barrier, but a broken maze of coral reefs and cays (ledges). There are approximately 2,800 individual reefs, of which 760 are fringing reefs that form against or near an island or continental coast and grows seaward, sloping sharply toward the seafloor.

The Great Barrier Reef provides habitats for abundant forms of marine life. The reef is the largest structure ever built by living creatures, and consists of thousands of separate reefs, islets, and islands. The reef contains approximately 1,500 species of fish, 400 species of sponges, 4,000 different types of mollusks, and approximately 400 species of hard, reef-building corals. The coral is a growth of calcareous (calcium or calcium carbonate) remains accumulated over a period of some 25 million years. The marine life of the warm, clear waters of the reef is plentiful and varied, consisting of anemones, marine worms, gastropods, crayfish, lobsters, prawns, crabs, starfish, sea urchins, and a great variety of fish and seabirds. Among the better known species are the crown-of-thorns starfish (*Acanthaster*), the giant clam (*Tridacna gigas*) the deadly box jelly, sea wasps, and many brightly colored fishes.

The reef also supports a wide variety of fleshy algae that are eaten by the resident turtles, fish, sea urchins, and mollusks. The reef is the habitat of such endangered species as the dugong sea cow and the large green loggerhead turtle. The reef sea-grass beds are an important feeding ground for the dugong and are a nesting ground for the loggerhead turtles. It is also a breeding area for humpback whales, which come from the Antarctic to give birth to their young in the warm waters. The islands and cays support several hundred bird species, many of which have breeding colonies there. Reef herons, osprey, pelicans, frigate birds, sea eagles, and shearwaters are among the numerous sea birds that have been recorded.

The Great Barrier Reef Marine Park was acknowledged in 1975 with the purpose of preserving the area's outstanding biodiversity while allowing reasonable use for local economy through zoning laws. The environmental risks related to shipping within the Great Barrier Reef are operational pollutants and accidental pollutants, the major threat being from oil, either carried as fuel or cargo.

There are over 30 historic shipwrecks in the area, as well as a scattering of islands ruins, operating and historically significant lighthouses, and World War II sites. Captain James Cook is believed to have been the first European to encounter the reef when his ship the *Endeavour* ran aground on it in 1770 near what is now Cooktown. Human involvement with the Great Barrier

Reef began thousands of years before Captain James Cook encountered the reef. Aboriginal peoples and Torres Strait Islander communities have fished, hunted, and gathered from its waters, islands, and adjacent coastal areas for thousands of years. These people have significant traditional cultural connections to the Great Barrier Reef. The many important cultural sites that are evidence of past and in some cases contemporary activity are one aspect of their living cultural heritage that exists across the islands and reefs in the Great Barrier Reef Region. The hunting of marine animals such as dugongs and turtles has long been part of Aboriginal culture, and these activities continue as part of the cultural heritage. Chinese fisherman and Japanese pearl divers also frequented the waters of the reef in the 19th and early 20th centuries.

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## great circle

A GREAT CIRCLE IS defined as a direction line that forms a full circle. This is also called a true azimuth. A great circle divides the Earth into equal halves and on the idealized surface of the Earth, the shortest distance between two points lies along a great circle. The equator is a great circle, as are all meridians of longitude. A great circle has a number of considerable properties. It is the largest possible circle on the globe, and every great circle has its center in the center of the Earth and its circumference is the circumference of the Earth.

One of the most important uses of great circle distances is by navigators of ships and aircraft. Measuring and determining direction is different between that on the spherical earth and that of flat surface direction finding. Traveling along a great circle (called the great circle route) is the shortest distance between two places on the Earth. Air and sea transportation lines tend to use great circle routes as much as possible to save on travel time and costs. Finding distances between points on a great circle is accomplished using the known lati-

tude and longitude of the two points and using trigonometric tables.

Users of the great circle route need to select the proper map PROJECTION to display properly a great circle route. Maps distort distances so the great circle route may appear longer than a straight line on a flat map. The only map projection that portrays great circles as straight lines is the gnomonic projection. The drawback to using this projection, however, is that they cannot illustrate a whole hemisphere in one map. Other azimuthal projections are sometimes useful for navigators looking at great circle routes because of their symmetrical nature, making all great circle routes passing through their centers appear as straight lines.

Another challenge appears when plotting a course using a great circle route. Compass direction along a great circle route varies constantly. To avoid constantly having to check and recalculate compass direction, followers of great circle routes can lighten their burden by following what is called a constant azimuth path. The difference between a true azimuth path and a constant azimuth path is that the true azimuth path is the shortest distance between two points on the surface of a globe and the constant azimuth path is the path followed by using a constant compass heading.

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## Greece

**Map Page** 1133 **Area** 51,012 square mi (130,800 square km) **Capital** Athens **Population** 10,665,989 **Highest Point** 9,626 ft (2,917 m) **Lowest Point** 0 m **GDP per capita** \$19,000 **Primary Natural Resources** bauxite, lignite, magnesite, petroleum.



FOR OVER 4,000 years, Greece has been at the crossroads of civilizations. The great empires of the Western and Eastern worlds met, clashed, and exchanged ideas

here. The ancient Greeks contributed to the development of European civilization in many ways, most notably in the areas of philosophy and politics. Shaped by their country's lengthy coastline and rocky inhospitable interior, the Greek culture has always been dominated by the sea, as much for the ancients as it is today. Modern Greece is bordered to the northwest by ALBANIA, to the north by the Former Yugoslav Republic of MACEDONIA (FYROM) and BULGARIA, and to the east by the AEGEAN SEA and TURKEY. To the west lie the Ionian Sea and ITALY. Like Italy, Greece comprises a peninsula that protrudes into the MEDITERRANEAN SEA.

Greece is known officially as the Hellenic Republic, taking its name from the classical Greeks' name for themselves, the Hellenes. At its height in the 5th century B.C.E., Classical Greek, or Hellenistic, civilization stretched from the western Mediterranean (Marseilles, FRANCE, was originally a Greek city) to the INDUS RIVER. Eclipsed by the rising Roman Empire in the 2nd century B.C.E., Greece reemerged as the center of the Mediterranean world with the founding of the city of Constantinople in 330 C.E., and the establishment of the Byzantine Empire. Byzantium slowly lost ground to the Ottoman Turks over several centuries, finally succumbing to conquest in 1453. For 400 years, Greeks struggled to maintain their identity as a people within the OTTOMAN EMPIRE, until a successful revolt in 1829 reestablished an independent kingdom of Greece, which, over the next 60 years, gradually extended its boundaries to incorporate the rest of the Greek peninsula and the islands of the Aegean Sea.

This expansion was halted after a disastrous war with Turkey in 1922, which resulted in the deaths or forced migrations of millions of Greeks from Asia Minor and Anatolia. Lingering tensions between the two nations are not helped by the fact that many Greeks would like to see such quintessentially Greek cities as Smyrna, Ephesus, and especially Constantinople itself (modern ISTANBUL) returned to the fold. Pressure exerted by the NORTH ATLANTIC TREATY ORGANIZATION (NATO) and the EUROPEAN UNION (EU), however, has worked to end this conflict that has spanned a millennium.

Greece joined NATO in 1952, became a parliamentary republic by removing its king in 1974, and joined the European Community (forerunner of the EU) in 1981. Although cut off geographically from the other nations of the EU, it remains a solid outpost of European development in Europe's southeast, and a strategic NATO partner at the doorstep of the MIDDLE EAST.

The modern nation of Greece consists mainly of the southern end of the Balkan Peninsula, and over 2,000 islands. A highly indented coastline stretches for over 8,400 mi (13,600 km). About 200 of the islands are inhabited, including the largest (and the fifth-largest in the Mediterranean), Crete. Greece's second largest island, Euboea, nearly forms part of the mainland, running parallel to the Attic Peninsula for roughly 900 mi (1,500 km). Other major islands in the Aegean include Rhodes, Cythera, Naxos, Samos, Chios, Lesbos, and Lemnos, plus the island groups of the Cyclades, Sporades, and the Dodecanese. To the west of the peninsula lies the Ionian Sea, in which are even more islands: the Ionian Islands (Cephalonia, Zante and Ithaca) and Corfu. Many of these islands are important wintering grounds for migratory birds.

The southernmost part of the Greek peninsula is nearly an island itself, the Peloponnesus, connected only by the narrow Isthmus of Corinth. This area was the site of powerful ancient city-states such as Mycenae and Sparta and the birthplace of the Olympic Games. Immediately to the northeast is the Attic peninsula, where the majority of the Greek population lives, in and around the city of Athens (Athinaí, with a metropolitan population of 5 million, or 40 percent of the total population). Attica is also the site of many of Greece's most ancient monuments, the city of Thebes, the oracle at Delphi, and several of the major battlefields of the ancient world, including the famous battle of Marathon, in 490 B.C.E., in which the Greeks defended their independence against the largest imperial power of the day, the Persian Empire. Greece's second largest city, Salonica (Thessaloníki), is much further to the north, and is the capital of the province of Macedonia, a major port and industrial center. Macedonia includes the third major peninsula on mainland Greece, Chalcidice (Khalkidhiki), with its famous Orthodox monastery of Mount Athos, which has been allowed to rule itself autonomously for centuries.

Because it is made up of so many mountainous peninsulas jutting out into the sea, Greece has only a few rivers over 62 mi (100 km) in length. The longest of these, the Aliákmon, is only 184 mi (297 km) long. This river, and the Piniós to the south, are the primary rivers that drain the plains of Greece's north-central regions (Macedonia and Thessaly). Greece has very few lakes, but there are three of significant size, one in each corner of Greece: Trikhonís in the southwest, Voivíis in the east, and Vegorrítis in the far north. The spine that runs down the center of the main Greek peninsula is the Pindus Mountain range. These stretch from the



highland province of Epirus in the northwest, down to Attica and across to the Peloponnesus in the south. A second mountain chain, the Rhodope Mountains, runs along Greece's northern border with FYROM and Bulgaria. The highest mountain in Greece, however, is not a part of either of these chains. Mount Olympus, reputed to be the home of the gods in Greek mythology, stands alone above the plain of Thessaly.

Thessaly forms one of the few places in Greece where the terrain is level enough to permit agriculture on a larger scale. The rest of Greece consists mostly of sharp, rocky hills, with a dry and temperate climate year-round, sufficient only for the cultivation of olives, grapes and goat's cheese, Greece's primary exports. Lacking rich farmland, the Greeks thus turned to the sea for their primary livelihood. Today, the Greek merchant fleet is the largest in the world (excluding non-nationally owned fleets, such as the multinational registries of LIBERIA or PANAMA). It is estimated that one family in 11 in Greece is connected in some way to the shipping industry and that Greek shipping accounts for 70 percent of all EU maritime commerce.

Other significant industries include tourism, especially with the exposure from the 2004 Olympic Games in Athens. Natural resources include bauxite (aluminum ore) and alternative power sources, including hydropower, geothermal, and solar energy, fueled by Greece's ever-present sunshine. There are estimated oil reserves in the eastern Aegean, but these have largely gone untapped because of yet another conflict with Turkey over how far each nation's boundary extends over the continental shelf.

Turkey is not the only nation that has disputes with Greece. Albania contests the borders of Epirus, claiming large numbers of ethnic Albanians living inside Greek borders, which official Greek statistics do not show. The Former Yugoslav Republic of Macedonia has been denied the use of its name "Macedonia" and its flag, the ancient symbol of Alexander the Great, since its independence in 1991. Although Greece dropped its economic blockade in 1995 (and allowed FYROM to take a seat at the United Nations), it continues to insist that the Slavic country drop its Hellenistic name and symbols.

Greece also firmly supports the claims of its Greek brethren to the entire island of CYPRUS, fanning the flames of continued ethnic strife with the Turks in northern Cyprus. Greece's far northeastern province, Thrace, where roughly 1.5 percent of the population are Turkish Muslims, is, by contrast, quite peaceful. A Greek-Turkish partnership in NATO, and potentially

in the EU, was furthered by the twin natural disasters of 1999. Rescue efforts from both nations were quick to come to the aid of victims of earthquakes only three weeks apart, leaving an impression of goodwill that bodes well for future regional cooperation.

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## Greenland

ONE OF THE MOST northerly territories in the world is Greenland, located between the North ATLANTIC, the northeastern coasts of CANADA (Ellesmere and Baffin islands), and the ARCTIC OCEAN. More than two-thirds of the region lies above the ARCTIC CIRCLE. Greenland is technically considered part of North America, though ICELAND (usually considered part of Europe) lies only 186 mi (300 km) to the southeast. Greenland is the world's largest island that is not considered a continent (like AUSTRALIA). It is roughly one-third the size of the UNITED STATES, and 50 times the size of its parent nation, DENMARK. Greenland has been a part of Denmark for centuries, officially integrated within the kingdom in 1953, but has had internal self-rule since 1978.

A victim (or beneficiary) of early Viking propaganda to encourage new settlements, Greenland is in fact mostly ice. The island consists almost entirely of a vast inland plateau covered in ice up to 9,800 ft (3,000 m) thick. It is estimated that this ice sheet, second in size only to ANTARCTICA, holds up to 10 percent of the world's frozen water.

The interior plateau is surrounded on all sides by mountains, the highest being those along the east coast (including Greenland's highest point, Gunnbjørn). A narrow coastal plain supports most of the settlements, mostly along the south-west coast. Here there is a short summer growing season, but, as in most of the rest of the island, the chief industry is fishing. Other economic activities include the hunting of whales and seals and, to some extent, tourism. Adventurous tourists are drawn to the rugged subarctic terrain and the dramatic

ice fjords but primarily to the celestial attractions: the northern lights and the midnight sun. North of the Arctic Circle, the sun never sets between late May and late July. The town of Ilulissat (Jakobshavn) is one of Greenland's tourism centers, both for the midnight sun and for its position among dramatic glaciers and icebergs that flow into Disko Bay. In contrast to the summer, however, most of these northern settlements see no sunlight at all from November to January. The east coast of Greenland is almost entirely uninhabited and has mostly been isolated from European contact.

Greenland's official name, Kalaallit Nunaat, means "land of the people." Most of its population are Inuits, closely related by language and culture to Canadian Inuits and Alaskan Eskimos. Migrations from North America occurred as recently as 150 years ago. Many traditional Inuit practices continue today, such as the use of kayaks in hunting (the word *qajaq* is Inuit), and the crafting of *tupilaks*, small grotesque figures carved in walrus tusk or reindeer antler to represent evil spirits. Europeans first arrived in southern Greenland around the year 1000, under the leadership of the Norwegian (Viking) chieftain Erik the Red.

By the early 15th century, however, these settlements were abandoned. English navigators charted the island again in the late 16th century, in the process of searching for the Northwest Passage to the Pacific. Danish and Icelandic settlers gradually established small fishing villages on the southwest coast, but it was not until 1921 that Denmark declared the entire island to be Danish territory, following the 1917 treaty by which Denmark sold the Virgin Islands to the United States, and in exchange, the United States relinquished its claims to the northern parts of Greenland.

Greenland has been developed economically only since the 1950s, as Denmark made strides to integrate Greenlanders more fully into the kingdom. There are still no roads between settlements, however, and attempts to commercially mine minerals beneath the interior ice cover (primarily zinc and lead) have been slow to develop. There is also potential for large deposits of uranium and oil, but these remain mostly unexplored. The population continues to rely heavily on subsidies from Denmark (nearly \$200 million a year). A 1978 referendum brought self-rule, and through a further vote in 1985, Greenlanders chose to leave the markets of the European Union after many years of haggling over fishing and mining rights.

The capital city, Nuuk (Godthåb, Danish for "the headland"), is a very modern city, built mostly since the 1950s, and housing over 13,000 people, three times

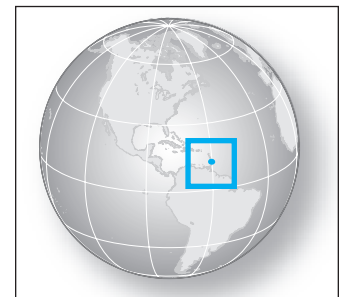
the population of the second-largest town. Rapid modernization has, however, taken a toll, and the city is marked with high unemployment, alcoholism, and teen suicide.

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## Grenada

**Map Page** 1137 **Area** 133 square mi (344 square km)  
**Population** 89,258 **Capital** Saint George's **Highest Point** 2,756 ft (840 m) **Lowest Point** 0 m **GDP per capita** \$5,000 **Primary Natural Resources** timber, tropical fruit, agricultural products.



GRENADA IS AN independent island country in the CARIBBEAN SEA. It is a member of the British Commonwealth. The country was in the news in 1983, when the UNITED STATES led a successful military invasion of the island to protect U.S. citizens there and to restore the island's parliamentary form of government. Free elections have taken place there ever since.

Grenada is one of the smallest nations in the Western Hemisphere; it is about twice the size of Washington, D.C. The country consists of the main island of Grenada, which makes up three-fourths of the country's total land area, as well as hundreds of mostly uninhabited tropical islets. Three landscapes divide the main island: a coral-lined shore, an agricultural plain fringed by mangrove swamps, and a mist-shrouded volcanic highland. Tropical storms and hurricanes traveling from the Atlantic Ocean menace the islands each year. Volcanic eruptions also threaten the tiny nation: A volcano (Mount St. Catherine) dominates the main island of Grenada and a submarine volcano (Kick-Em-Jenny), which is the most active volcano in the Windward Islands region, rumbles fitfully 5 mi (8 km) offshore. The climate is the tropical-wet type.

Temperatures average a sweltering 84 degrees F (29 degrees C) throughout the year. Northeast-flowing trade winds assure abundant moisture from June through November, when the Intertropical Convergence Zone (ITCZ) passes over the islands. Precipitation decreases noticeably when the ITCZ shifts south during the remainder of the year. Due to the prevalence of the northeast trade winds, there is a prominent rain shadow area on the leeward (southwest) side of Mount St. Catherine.

All but about 700 of the country's population lives on the main island of Granada. Approximately 82 percent of the people are black, 13 percent mixed black and European, and 5 percent European and East Indian. The only large urban center is the capital, St. George's (population 4,300). English is the official language, but most people also speak French patois. The main island's impressive production of nutmeg, cinnamon, ginger and cloves earns it the nickname Spice Island. Bananas, cocoa, citrus, avocados, sugar cane and root crops also earn income. Industry involves agricultural processing, construction, offshore financing, and tourism. Grenada was the world's second-poorest country based on the percentage of the population living below the poverty line in 2003. (DOMINICA, which is also a Caribbean nation, ranked first.)

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## grid/graticule

THE EARTH IS NOT spherical but rather an ellipsoidal shape where the north and south poles are flattened and the equator bulges. This unique shape is called a geoid. In order to uniquely locate features on the Earth's surface, a reference system is required. An imaginary network of lines called a grid or graticule is superimposed on the Earth to serve this purpose.

Although the terms *grid* and *graticule* are used synonymously, there is a subtle technical difference in their meaning. A graticule is a referencing system tied directly to the Earth's ellipsoidal shape. On the other hand, a grid is a network of perpendicular lines, much like graph paper, superimposed on a flat paper map to

provide relative referencing from some fixed point as origin.

The graticule is composed of longitude lines (meridians), which run north-south, and LATITUDE lines (parallels), which run east-west. The longitude lines converge at the North Pole in the Northern Hemisphere, and at the South Pole in the Southern Hemisphere. The equator divides the Earth into two hemispheres. All meridians and the equator are great circles since they can form planes that cut the surface and pass through the center of the Earth. Small circles such as latitude lines form a plane that cuts the surface but does not pass through the center of the Earth. In this system of reference, geographic coordinates are measured in units of angular degrees.

There are 360 degrees of longitude around the equator, with each meridian numbered from 0 to 180 degrees east and west such that the 180 degree meridian is on the opposite side of the Earth from Greenwich, England. There are 180 degrees of latitude from pole to pole, with the equator being 0 degrees and the north and south poles being 90 degrees. Each degree is divided into 60 minutes (60') and each minute is divided into 60 seconds (60"). The north-south line is called the prime meridian, which has been arbitrarily set to pass through the Royal Observatory in Greenwich, England. The longitude is measured as the angle between the point, the center of the Earth, and the prime meridian at the same latitude. West is positive and east is negative, meeting at 180 degrees at the international dateline. The east-west line follows the equator and is midway between the north and south poles. Degrees of latitude are measured as the angle between the point on the surface, the center of the Earth, and a point on the equator at the same longitude. In this graticule reference system, the size of the cells is largest at the equator and the zones are square. At the poles, the zones are smallest and triangular.

When the three-dimensional Earth is projected unto a flat paper map there are distortions in distance, area, and direction, and the projection process attempts to minimize these distortions when transferring the curved Earth to the flat map. The projection process affects both the graticule and Earth features. On the flat map there is no natural reference point, but one can be defined using an arbitrary system of coordinates. A grid of intersecting parallel and perpendicular lines is placed over the projected map such that the origin of the grid lines fall on a point of interest on the map. This arrangement is called a grid reference system, and every point on the flat map can be located

with a unique X and Y coordinate. Usually, the X coordinates are referred to as eastings and the Y coordinate as northings. An example of a grid system is the Universal Transverse Mercator (UTM) system.

Graticules are always expressed in geographic coordinates (latitude and longitude) while grids are expressed in some locally defined X and Y coordinate system. In projected coordinate systems, graticules will appear as curved lines (when necessary) to follow the curved form of the meridians of longitude or parallels of latitude in the projection. Grids, however, will always appear as an arrangement of horizontal and vertical straight lines.

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## growth pole

GROWTH POLE REFERS to the concentration of highly innovative and technically advanced industries that stimulate economic development in linked businesses and industries. This concept was first introduced by François Perroux in 1950, was further sharpened in following publications, and finally evolved into an idea that came to take on a meaning rather different from the one posited by Perroux. While he had conceived a growth pole to be a focus of economic development in an abstract economic space, it was interpreted by his disciples, particularly Jacques Boudeville, to be a focus of development in geographic space.

Perroux, a 20th-century French economist, was largely influenced by the ecopolitical climate around him when he wrote about the concept of the growth pole. At this time, France was in its post-World War II phase of rebuilding itself under the Marshall Plan. Urban areas were the primary centers of economic growth, relying on technology- and innovation-based

industries that thrived on primary resources such as iron ore or agricultural products from the surrounding region. These concentrations of industries often affected the economies of geographical areas outside their immediate regions. Also apparent to Perroux was the dominance of colonial centers over geographically dispersed colonized areas.

Perroux's observation and belief was that concentrations of economic forces would develop in areas that could provide the material and infrastructural resources necessary for the establishment, sustenance, and growth of key industries. These resources contributed toward the economic growth of this cluster of industries and caused them to become key or "propulsive" industries that caused an economic thrust in related industries and businesses through "fields of (economic) forces." The thrust was not necessarily felt in the growth pole's surrounding region, or even within its country of location. Therefore, this concept recognized the forces of polarization but did not recognize geographic or political boundaries.

However, Jacques Boudeville and other interpreters of Perroux's growth pole concept replaced "economic space" with geographic space, an idea that was readily adopted by regional planners and economic geographers who were pressed into making economic development plans on a regional scale. The idea was to identify selected nuclei for industrial growth to stimulate development in the surrounding area instead of focusing on the underdeveloped region as a whole. This idea was then touted as a remedy for jump-starting the slumping economies of entire regions or inducing development into economically retarded areas.

As history has shown, this theory did not readily translate into practice when it was applied in the developing world, and growth could not be injected into a geographic region by adding a growth pole into it. A more comprehensive territorial approach seemed to be more appropriate for both rural and urban development. Even in the developed world, Dutch national planning experience aimed at correcting regional imbalances by earmarking less developed areas for growth during the 1950s and 1960s did not have the desired "spread effect" in the surrounding area. It has since been realized that the failure was not of Perroux's growth pole theory but of its faulty application as a space-bound concept, and a remedy for all regional underdevelopment.

Today, as economic interaction encompasses macroregions and becomes globalized, Perroux's original theory seems likely to find validation. A recent ex-



ample of such growth pole effects may be found in the Silicon Valley in San Jose, CALIFORNIA. The information technology (IT) industry here grew at a meteoric rate in the 1990s, but the economic stimulus was not restricted to the state of California or even the United States. Its impact was felt through increased employment and social development in the developing countries of Asia halfway around the globe.

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## Guadeloupe

GADELOUPE, IN THE CARIBBEAN SEA, is one of the four French overseas departments (similar to states in the UNITED STATES). Guadeloupe is also a French region. There are two main islands, Basse Terre and Grande Terre, separated by a strip of water called the Rivière Salée. Other outlying inhabited islands are dependencies, namely Saint Martin, St Barthélemy, Désirade, Marie Galante, the Petite Terre and Saintes Islands. These territories are collectively known as Guadeloupe.

The climate is tropical and humid and the dry season runs from December to May (*carême*). During the rainy season (*hivernage*), June to November, temperatures generally rise. Guadeloupe's climate is tempered by trade winds, but hurricanes and cyclones often wreak havoc in the area. Neighboring islands in the southwest Caribbean include the UNITED KINGDOM'S ANGUILLA and the NETHERLANDS ANTILLES.

The landscape is mountainous in the west (Basse Terre), and thick forest covers the slopes and thins out nearer to the coast. The highest point in Guadeloupe is La Soufrière in Basse Terre, a live volcano. Low limestone plateaus and coastal cliffs are typical of Grande Terre in the East. The other outlying islands are mainly

volcanic. Approximately a third of the population lives in densely populated Point à Pitre on Grande Terre island.

Guadeloupe was colonized in 1635, and in spite of spells of British occupation in 1759, 1794 and 1810, the island remained a French possession. The native Indian inhabitants were massacred, and the bulk of today's black and mulatto population is descended from the slaves imported into Guadeloupe to labor on the sugar plantations. East Indians and some Chinese and Lebanese also contribute to the diversity of the population. Slavery was abolished in 1848, and the colony became an overseas department in 1946 and a region in 1982. As such, Guadeloupe is a member of the EUROPEAN UNION. The official language is French, but French Creole is spoken by the black and *métis* population.

Guadeloupe enjoys the same advantages as any other mainland French department or region in terms of health, education, and social welfare. The islands also benefit from special measures aimed at encouraging economic development (lower income tax for example). The islands are also popular tourist destinations for the French. Nevertheless, government subsidies are essential to Guadeloupe's economic survival.

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## Guam

A U.S. TERRITORY, the island of Guam is one of the largest islands in the north PACIFIC OCEAN, located about three-quarters of the distance from HAWAII to the PHILIPPINES.

Its harbor, one of the best in the world, underlies the importance the island has held for the last five centuries to foreign powers in the region, first SPAIN, and now the UNITED STATES. Guam is the southernmost island of the chain known as the Mariana Islands and has been a territory of the United States since 1898. Much of the local economy is dependent on the U.S. military presence and on heavy subsidies, so it is un-

likely there will be any moves toward independence in the coming years.

The island is 48 mi (77 km) long and roughly 4 to 9 mi (6 to 15 km) wide. Its closest neighbors are the Northern Mariana Islands, a U.S. commonwealth, and the newly independent Federated States of MICRONESIA to the south. Guam lies at the crossroads of TRADE ROUTES, 1,488 mi (2,400 km) east of Manila (Philippines), 1,612 mi (2,600 km) south of TOKYO (JAPAN), and 3,658 mi (5,900 km) west of Honolulu, Hawaii.

Guam was formed by successive undersea volcanoes, which are older and more worn by erosion in the north, and younger in the south. The more hilly south has more streams and is thus more conducive to agriculture. The north is a coralline limestone plateau, with steep cliffs along the coasts. As part of the Pacific ring of fire, Guam also suffers from earthquakes. Coral reefs surround the island on all sides, causing some dangers for boats, which are increased by heavy swells and swift currents. Apra Harbor, located about 5 mi (8 km) southwest of the capital, is one of the best natural harbors in the Pacific, providing ample shelter during typhoons, which hit the island at least two times each year. The worst of these to strike in recorded history was in 1982, causing a great deal of damage.

The climate is maritime tropical, with little temperature variation, but increased rain during the southwest monsoons, July to October. Lush vegetation covers the island, with vines and palm trees, and tropical produce like bananas, breadfruit and coconut. Of particular value is the ironwood tree, termite resistant and extremely hard, now protected by law. There is limited natural wildlife, mostly birds, bats, insects, and sea turtles. The reefs have abundant tropical fish, squid and sharks. The nearby Challenger Deep in the Mariana Trench, at 35,838 ft (10,924 m) below sea level, is the deepest point on the planet.

The islands were populated by migrants, probably from the Philippines or Malay, who set up a number of chiefdoms based on matrilineal clans. Ferdinand Magellan landed here in 1521 on his way around the world and named the islands (the whole chain) the Ilhas das Velhas ("islands of sails" after the triangular-shaped sails used by the natives, known as Chamorros).

They were also sometimes called, pejoratively, the Ilhas de Ladrones ("thieves"). Although renamed by Spanish authorities the Marianas, in honor of the Queen of Spain, Mariana of Austria, the natives continued to call their island Guahan, or Guam. The Spanish did not settle here, but used it as a stop-off point in

their annual trade convoys between MEXICO and the Philippines. Jesuit missionaries arrived in the later 17th century, and permanent settlements began. Struggles with colonial administrators and the introduction of European diseases quickly reduced the native population from an estimated 50,000 to 100,000 in 1600 to a mere 5,000 by the end of the century, reaching record lows of about 1,500 in 1780. The United States took over the island from SPAIN in 1898 and established a large military presence; the island was at first essential as a coaling station for ships crossing the Pacific, then as a fueling stop for transpacific flights. After a brutal occupation by Japanese forces from 1941 to 1944, Apra Harbor served as a main airbase during the Vietnam War era.

Guam remains an unincorporated territory under the administration of the Department of the Interior. In a 1982 referendum, Guamanians requested commonwealth status, and a Guam Commonwealth Act, approved in two plebiscites, has been repeatedly submitted to Congress since 1988 but has been stalled, perhaps from U.S. military concerns on the island. Its culture is very American, and almost entirely urban. Most Chamorros seem happy with that, except there is a growing fear of being overwhelmed numerically by Filipino immigrants.

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## Guatemala

**Map Page** 1136 **Area** 67,661 square mi (108,890 square km) **Population** 13,909,384 **Capital** Guatemala City **Highest Point** 13,815 ft (4,211 m) **Lowest Point** 0 m **GDP per capita** \$3,900 **Primary Natural Resources** petroleum, nickel, rare woods.



THE REPUBLIC OF GUATEMALA is located in Central America and is bordered by the PACIFIC OCEAN, the Gulf of Honduras, otherwise known as the CARIBBEAN SEA, and four countries (EL SALVADOR, HONDURAS, BELIZE, MEXICO). The total length of the borders is about 1,296 mi (2,087 km), and the landscape is largely mountainous, with a limestone plateau. The two coastal areas are very narrow. Latino and Amerindian are the two major ethnic groups in Guatemala.

### VOLCANIC REGION

The mountainous areas of Guatemala are home to over 30 volcanoes. Many volcanoes are still active and this area experiences occasional earthquakes and volcanic eruptions. The Caribbean coastline is very narrow and beaches are nonexistent, while the Pacific coastline is characterized by black-sand beaches. Guatemala is intensely cultivated and agriculture employs 50 percent of the workforce; some people work on sugarcane and banana plantations.

Guatemala also features the Peten RAINFOREST, which is an archaeological treasure where many dinosaur bones can be found in the soil. However, the existence of the Peten rainforest, located within the interior of Guatemala, is being threatened as trees are being cut down. Soil erosion and water pollution also pose a great concern for the environment.

Guatemala has a tropical climate that varies with elevation. The country's coastal regions are generally hot throughout the year, with usual temperatures reaching up to 100 degrees F (38 degrees C). The summer seasons are hot and humid, while winters are warm and dry. These regions are susceptible to hurricanes and other tropical storms. The highlands are generally wet and cloudy during the summer, and the temperatures are not as hot as in the coastal regions because of the higher elevation. The climate in the Petén rainforest is mostly wet year-round. Summers are hot while winters are warm. There is a brief dry season from February to April. The rainforest is home to a variety of wildlife, which is in danger because of deforestation. The quetzal, the national bird, is almost extinct. Pumas, jaguars, ocelots, deer, tapir, and margay are among many of the animals living there.

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## guerrilla base

A GUERRILLA BASE or base area is a physically secure geographic location used by political dissidents from which they can launch military attacks. Historically, such bases were local or national. In 2003, the process became global, with guerrilla bases of al-Qaeda staged in AFGHANISTAN, PAKISTAN, the PHILIPPINES, SUDAN, and possibly South America. Since guerrilla bases are not randomly located and must provide both security as well as political access, their locations become somewhat predictable.

Using special geographic areas for political dissidents is not new. However, in the 1920s, Mao Zedong in CHINA developed specific guidelines for the location and geopolitical nature of such bases. For optimum political impact as well as general security of the participants, such bases should meet as many of the following location or geographic criteria as possible:

1. It is best if an area or group has had previous experience in anti-government protests or activities.
2. Ideally, a base should be located where there are multiple political or administrative boundaries that create confusion in terms of local government authority.
3. A location should be chosen that provides access to a multiplicity of political targets that are demographic, economic, or political.
4. The area selected should provide some kind of physical advantage against government military attack, for example, mountains, jungles, swamps, distance from formal military units.
5. To the extent possible, the location should be capable of economic self-sufficiency. That is, it should be largely invulnerable to the withholding of food or essential supplies.

The use of these geographic conditions can be applied at all scales, from national to regional and even in an urban context with appropriate modifications, for example, high-rises and slums may equal rugged topography and jungle analogues. The key is target access and personal safety. It is the objective of these groups that distinguishes them from simple bandit hideouts like those used by Jesse James and others.

The ultimate objective is for each base area to become a proto-province or political unit. The creation of many base areas begins to form a geopolitical system and eventually an entire insurgent state. This was a calculated process in China during the civil war and has

been used with varying degrees of success in almost all modern guerrilla wars.

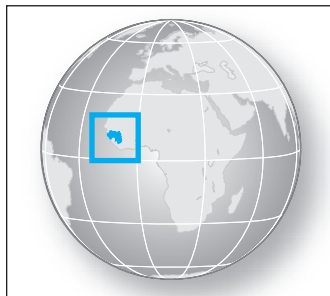
The modern variation on this process is where an insurgent political movement (in this case, al-Qaeda) seeks to create bases among sympathetic concentrations of Muslims, regardless of where they may be located (Detroit, MICHIGAN, or the southern Philippines). The process is the same. Find a sympathetic population and locate in an area that has access to political targets yet provides some physical safety. In some instances, this safety has been provided by a sympathetic national government as in Afghanistan under the Taliban, and in Pakistan or YEMEN at various times.

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## Guinea

**Map Page** 1113 **Area** 94,925 square mi (245,857 square km) **Population** 9,030,220 **Capital** Conakry **Highest Point** 5,748 ft (1,752 m) **Lowest Point** 0 m **GDP per capita** \$340 **Primary Natural Resources** bauxite, iron ore, diamonds, precious metals.



GUINEA IS LOCATED in the southwestern part of West Africa. It is bordered by GUINEA-BISSAU, SENEGAL, and MALI to the north, by CÔTE D'IVOIRE to the east and southeast, by LIBERIA and SIERRA LEONE to the south, and by the ATLANTIC OCEAN to the west. Guinea is a humid tropical country with four main geographic regions.

There are alluvial coastal plains in Lower Guinea; the mountainous Fouta Djallon highlands in Middle Guinea, with an average elevation of 3,000 ft (915 m); the northern savanna in Upper Guinea; and the south-

eastern rainforest in Forest Guinea, which includes the Nimba Mountains.

Lower Guinea, also known as Maritime Guinea, stretches from the Atlantic Ocean inland to and including the foothills of the Fouta Djallon mountains. Tides along the coast are very high, reaching 15 ft (4.5 m), and creating an area of brackish marshes and estuaries that stretch many miles inland. Past these swamps is the alluvial plain, which is on average 30 mi (48 km) wide. Periods of heavy rain cover these plains resulting in soggy soil, but this along with the equatorial heat favor agriculture in this area. The people of Guinea grow rice, millet, maize, oil palms, kola trees, and in the southern part of Lower Guinea, bananas and pineapples. Originally living in this area were the medieval Ghana people; later it became part of the Mali Empire. Currently, the Soussous inhabit this area.

Middle Guinea is covered by the Fouta Djallon Mountains, which consist of a mass of complex, elevated, relatively level plateaus. In many places, these plateaus are cut with deep, steep-walled valleys. Most of these valleys extend for long distances; many are at right angles to each other, creating a checkerboard appearance to the region. Many of the major African rivers begin in this area, including the Gambia, the Senegal, the NIGER, and 19 others. Living in Middle Guinea are the Peuhl, who raise cattle in the highlands.

Upper Guinea stretches east of the Fouta Djallon and is covered in tall grass savannas. This area is cut by a long rocky spur stretching eastward along the Mali border for over 100 mi (160 km). Some shorter spurs also stretch east from the Fouta Djallon. Along the western border with Mali are rounded granite domes rising above the plains. This area is inhabited by the Malinke people, who also make up part of the inhabitants of the Forest region.

Forest Guinea covers the southeastern corner of Guinea. This area has several peaks above 4,000 ft (1,220 m). Many of these peaks are lightly forested and have crests of bare rocks. Below 2,000 ft (610 m), this area is covered in dense rainforest. The Malinke and other small groups, including the Gerze and Toma peoples, inhabit this area. They raise cattle and cultivate crops of rice, maize, cassava, bananas, coffee, kola trees, and oil palms.

FRANCE gained control of Guinea in 1898 when it defeated the armies of Samori Touré, a warlord and leader of Malinke descent. The French negotiated for the boundaries of Guinea that are in use today. On October 2, 1958, France withdrew from Guinea in the face of the Democratic Party of Guinea, led by Sékou



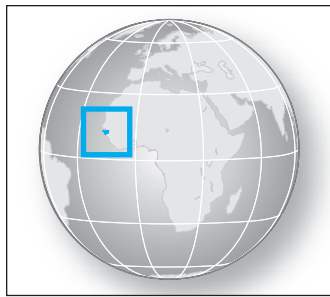
Touré and backed by almost the entire native population of Guinea. Guinea became a dictatorship until Touré's death in 1984. Since then, President General Lansana Conté has created civilian rule and democratic reform in Guinea.

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## Guinea-Bissau

**Map Page** 1113 **Area** 13,942 square mi (36,120 square km) **Capital** Bissau **Population** 1,360,827 **Highest Point** 984 ft (300 m) **Lowest Point** 0 m **GDP per capita** \$700 **Primary Natural Resources** fish, timber, phosphates, bauxite, petroleum.



THE REPUBLIC OF Guinea-Bissau, commonly called Guinea-Bissau, is a tropical West African nation-state. The borders include the ATLANTIC OCEAN on its west, GUINEA to its south and east, and SENEGAL to the north. Guinea-Bissau is an ethnically diverse country. While most of its residents are indigenous Africans, they belong to various ethnic groups. Thirty percent belong to the Balanta group, 20 percent are Fula, 14 percent are Manjaca, 13 percent are Mandinga, and 7 percent are Papel. The remaining are of European descent or mixed African and European ancestry.

Approximately 50 percent of the population adheres to indigenous African religions that recognize many deities and venerate ancestors. Forty-five percent identify themselves as Muslims and 5 percent as Christians. Portuguese is the official language of the country, although such native languages as Fulah and Mande are also in wide use.

The area was home to agricultural groups during the European Middle Ages. In the centuries before European contact, Guinea-Bissau underwent profound cultural, political, and population shifts. During the

early 13th century, the displaced Soninke, an ethnic group from GHANA, fled to Guinea-Bissau when the Almoravids subjugated Ghana. Later, the area became a coastal outpost of the Mali Empire.

Portuguese advancement in ocean navigation and their desire for new sources of wealth combined in the mid 1400s to lead Portuguese explorers to northern and western Africa. Portuguese slave traders captured Guineans and sent them to plantations on CAPE VERDE, an island group off Guinea-Bissau's coast. In the late 1600s, Guinea-Bissau became PORTUGAL's first colony on the African continent. Despite pressures from other European colonial powers and colonized ethnic groups, Guinea-Bissau remained under Portuguese authority until 1974, when, after a 10-year war of independence led by the African Party for the Independence of Guinea and Cape Verde, the Republic of Guinea-Bissau was proclaimed.

The first 30 years of independence were fraught with difficulty. In 1980, Guinea-Bissau's first president, Luis de Almeda Cabral, was overthrown by Prime Minister João Bernard Vieira. Supported by the military, Vieira ruled for 18 years, during which several unsuccessful coups were staged, political opposition was crushed, and ethnic tensions increased. Since 1998, Vieira and Kumba Yala, elected in 1998, have been deposed from power by coups.

Partly because of political turmoil, an undeveloped infrastructure, and a dependence on subsistence agriculture, Guinea-Bissau languishes in poverty. Today, the country is one of the poorest nations in the world. Using key health indicators for 2001, poverty has compromised Guinean health. At birth, for example, Guinean women have only a 40.6-year life expectancy. Men are expected to live 36.1 years. Infant mortality rates of 195 and 213 per 1,000 live births for Guinean female and male children, respectively, rank among the highest in African regions according to the World Health Organization. Economic and health improvements are possible with international effort but only through sustainable growth projects that take the natural environment, citizens, and industry into consideration.

As a republic, Guinea-Bissau is in its infancy, and as the 21st century unfolds, whether it matures into a stable country will be determined by its people and their leaders.

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## Gulf of Aqaba

THE GULF OF AQABA is the north arm of the RED SEA; it is bordered by ISRAEL, JORDAN, EGYPT, and SAUDI ARABIA. Created by seismic activity along the Afro-Syrian Rift, it is the northernmost extension of the Red Sea. It is a semi-enclosed water body that extends south some 111 mi (180 km) from Eilat and Aqaba and joins the Red Sea at the Straits of Tiran, with its widest point spanning 17 mi (28 km).

Israel's gulf shore extends only a few kilometers, from the city of Eilat to the border with Egypt at Taba. Jordan's shore reaches some 12 mi (20 km) in length, before meeting with the Saudi Arabia border. Egypt enjoys the longest gulf border, which stretches some 105 mi (170 km) along the SINAI PENINSULA between Taba and the Straits of Tiran. The Gulf of Aqaba supports a world class coral reef ECOSYSTEM that is noted for its intense beauty and accessibility. The gulf is exceptionally deep, as much as 5,905 ft (1,800 m) in some points, with an average depth of 2,624 ft (800 m). Because of its desert environs, very little freshwater flows into the Gulf of Aqaba and its southern mouth at the Strait of Tiran is extremely narrow. As a result of these factors, the gulf is a highly saline, still environment, with limited hydrological interface with the Red Sea.

Waters that have been used for centuries for fishing, trading, and the transport of religious pilgrims are today shared with oil tankers, massive cargo ships, and growing fleets of tourists. These increased high-impact and potentially devastating uses are of concern. Increased international and regional cooperation regarding conservation, pollution, and sustainable use have been encouraging.

In May 1967, during a time of attempted pan-Arab nationalism, President Abdul Nasser of Egypt closed the Gulf of Aqaba by blockading the Straits of Tiran and pledged that "under no circumstances will we allow the Israeli flag to pass through the Aqaba Gulf." Israel's military reaction gave proof to the Gulf of Aqaba's strategic and political importance to the na-

tions of the region. The Straits of Tiran played a critical role in the Arab-Israeli 1967 war, was returned to Egypt in the wake of the 1973 war, and has been monitored by a multinational peacekeeping force since 1982.

Lying along the international waterway through the Suez Canal, the Gulf of Aqaba is a natural transshipment area. Improved relations among the bordering nations have encouraged the development of the Aqaba-Eilat region as a commercial gateway between Asia, Europe, and Africa. Continuing improvements of the ports and transportation infrastructure have increased the Gulf of Aqaba's role as a regional transshipment point between the MAGHREB countries and the PERSIAN GULF. Future proposals include upgrading the Port of Aqaba, establishing inland logistic centers, improving transportation networks, building manufacturing and storage facilities, and creating international passenger and commercial airports. This complex would then be connected to other Red Sea and MEDITERRANEAN SEA ports by railroad. Such ambitious projects and proposals have been presented by the Jordanian, Israeli and Egyptian governments.

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## Gulf Stream

THE GULF STREAM, a relative newcomer on the geological scene, is an odd, fast-moving circulation of warm water that travels in an unfixed position, a few hundred miles north of FLORIDA, up the east coast of the UNITED STATES to Cape Hatteras, NORTH CAROLINA, then onto Nantucket Island, before kicking eastward across the ATLANTIC OCEAN to the British Isles.

In this way, the Gulf Stream, a part of the western edge of the North Atlantic circulation, acts as a boundary that prevents the warm water of the SARGASSO SEA from overflowing the colder, denser waters on the inshore side.

The Gulf Stream is one of the strongest and most extensive known currents in the world, and it is separated from the United States by a narrow strip of cold water. The Gulf Stream, which can be as much as 50 mi (80 km) wide and 1,300 ft (400 mi) deep, is caused by the northeast and southeast trade winds on the surface of the water and the equatorial currents that meet in the region of the windward islands of the CARIBBEAN SEA.

The Gulf Stream's rival, the KUROSHIO CURRENT, located along the western edge of the PACIFIC OCEAN and the coast of JAPAN, is part of a transpacific system that connects the North Pacific, California, and equatorial currents. The Gulf Stream triples in volume and is strengthened by the waters from the Florida Straits, by way of the Florida Current, and by currents coming from the northern and eastern coast of PUERTO RICO and the BAHAMAS. It can travel more than 60 mi (96 km) a day.

The Gulf Stream, first mapped by Benjamin Franklin and his American whaling captain cousin Timothy Folger, early pioneers in using temperature in an attempt to define its boundaries, maintains its dimensions for nearly 1,000 mi (1,610 km) up the East Coast of the United States. Franklin, using observations of current speed in the region of the Gulf Stream and plotting them on a chart, was able to draw a river traversing the Atlantic Ocean with speeds ranging from 4 to 2 knots.

The strong carry power of the Gulf Stream's warm equatorial layers of water has a notable, almost direct effect on the climate in various parts of the Earth. As the Gulf Stream moves past Cape Hatteras, NORTH CAROLINA, it begins to flow away from the East Coast of the United States. The altered flow of the Gulf Stream, known as meanders or eddies, separates the cold slope water to the north from warm Sargasso Sea water to the south. As the Gulf Stream flows into deeper water, it carries warm water to the North Atlantic region, as it enters the Norwegian Sea between the FAROE ISLANDS and Great Britain. Thus, the Gulf Stream, which bathes northwest Europe with warmer water and wind currents, is largely believed to be the reason for mild European climate.

Too warm to encourage the kind of fish that are the main catch of North Atlantic waters, the Gulf Stream does bring well-developed specimens of tropical fish, like the Portuguese man-of-war jellyfish, much farther to north than they would normally venture. In addition, there are two particular species of plant (the double coconut tree indigenous to JAMAICA) and animal life



*The Gulf Stream has attracted the attention of many scientists and is probably the most studied example of ocean circulation.*

(the freshwater eels of Europe) that are carried for thousands of miles by the Gulf Stream surface transport system to the shores of IRELAND and Scotland.

Because the current patterns of the oceans has been the same as it is today throughout historical time, it becomes easy to understand that the Gulf Stream played an important role in the history of the New World. Indeed, it was during the early days of discovery of the West Indies, including the large islands of CUBA, HAITI, and Jamaica, that the Gulf Stream was first reported by Juan Ponce de Leon. During the American colonial period, the principal ocean routes for New England traders of rum and sugar and species—the direct northerly route influenced by clockwise circulation of the North Atlantic and the southwest route influenced by the clockwise currents northward past Florida—played their part in the development of North America. Through the advent of frequent voyaging between the Old World and the New, the Gulf Stream came into its own as the most comfortable homeward route from the West Indies to Europe.

As we now understand, the Gulf Stream can be regarded as merely the outer edge of a general rotation of the surface waters of the North Atlantic. As such, it deserves its popularity with mankind because, in general, it has a benign influence on man's affairs. The Gulf Stream has attracted the attention of many investigators and is probably the most studied example of ocean circulation. Although it can be questioned whether the

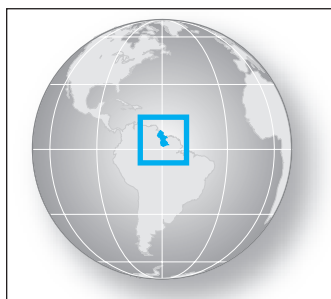
Gulf Stream should be considered as a separate entity or regarded as the outer edge of the North Atlantic circulation, it is still one of the largest and fastest of the water circulation of the seas. It has always played an important role in the lives of people who live on the land that borders the North Atlantic.

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## Guyana

**Map Page** 1140 **Area** 76,772 square mi (196,850 square km) **Population** 702,100 **Capital** Georgetown **Highest Point** 9,355 ft (2,835 m) **Lowest Point** 0 m **GDP per capita** \$4,000 **Primary Natural Resources** bauxite, gold, diamonds, hardwood.



**THE NAME** *Guyana* possibly comes from a local native word meaning “land of water,” but it could also derive from the word for “honorable people.” These Carib roots help demonstrate Guyana’s difference from the rest of the South American continent as one of the three non-Hispanic states on the northeast coast, wedged between VENEZUELA, BRAZIL, and SURINAME. Culturally, linguistically and economically, the three Guianas (along with Suriname, formerly Dutch Guiana, and FRENCH GUIANA) belong to the Caribbean region, and have been members of Caribbean regional associations since their inception.

The former British Guiana has a coastline of 285 mi (459 km), with the rest of the country stretching inland, encompassing the watershed of the largest river, the Essequibo, as it drains from the Guiana Highlands to the ATLANTIC OCEAN. The coastal regions are swampy, with river estuaries that provide an abundant harvest of shrimp, one of Guyana’s major exports. Much of this area is below sea level and relies on exten-

sive dykes and drainage systems; still many houses are built on wooden stilts. The interior gradually increases to small hills, forest uplands, then mountains (the Pakaraima Mountains, up to 3,000 ft or 915 m shared with Venezuela and Brazil). Unlike the other two Guianas, Guyana also extends south of this band of mountains, into an area of tropical savanna grassland. Aside from this, forests cover approximately 80 percent of the country.

Hardwoods are exported and used for the manufacture of wood products, but forestry is possible only in areas accessible by existent roads or navigable rivers—both very limited beyond the first foothills. The frontier between lowlands and highlands is marked by striking natural features, including Kaieteur Falls, one of the highest waterfalls in the world (total drop of 822 ft or 250 m).

The highlands also contain significant mineral wealth, especially gold, but also diamonds, manganese, copper, and molybdenum. Bauxite (used to produce aluminum) was a big business in Guyana since the opening of the Demerara Bauxite Mining Company (DEMBA) in 1917. Reynolds Metal Company followed in 1953, and these two companies formed an essential component of the country’s economy.

After independence from Britain in 1966, both companies were nationalized, and production declined in the following decades, until production was stopped altogether in 1983. Other resources remain unexplored and are potentially significant (iron, lead, silver, platinum) but are located too far from main roads or rivers to be commercially viable, and claims from Venezuela to nearly 70 percent of Guyana’s territory (the land west of the Essequibo) have also deterred some foreign investors.

The remoteness of much of southern Guyana was also an attraction for the People’s Temple cult, originally from the UNITED STATES, which made international headlines in 1978 after the mass suicide/murder of nearly 1,000 of its members.

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## Hainan Island

THE SECOND-largest island (after TAIWAN) in CHINA with an area of 13,104 square mi (33,940 square km), Hainan Island is the most southerly province located in the South China Sea. The island is situated south of Guangdong province and west of VIETNAM. The topographic structure of the island resembles a staircase, with towering mountains in the middle and descending hills, plateaus, and plains toward the periphery.

Hainan Island enjoys a tropical maritime climate with abundant rainfall and year-round sunshine. The annual average temperature is about 77 degrees F (25 degrees C) and the average rainfall is 63 in (160 cm). Winter and spring are considered the dry seasons, while summer and autumn are wet. Good sunlight, heat and water allow a rich variety of crops like rice, tropical fruits, and coconut to be cultivated on the island. It is rich in mineral resources such as salt, natural gas, iron ore, and oil.

But the island is also exposed to tropical storms and typhoons that hit the southeastern coast from July to September. Although geologically stable, it has a history of volcanic eruptions and mild earthquakes. Diseases ranging from malaria to mosquito-borne viruses plague the island.

Hainan Island is home to over 4,200 plant species and some 560 animal species, making it a destination

for researchers. But deforestation could well threaten species extinction. The island is also a growing destination for tourists. Mainland Chinese and foreigners mostly flock to the southern coastal city of Sanya for surf and sun. In addition, the island has played host to international events like the Miss World Contest and Boao Forum for Asia.

Historically, the Li ethnic peoples were the first to inhabit the island 3,000 years ago. Other ethnic groups include the Miao and Hui peoples. The Han Chinese form the majority group. Backward and remote, the island was a place for exiles. In the early 20th century, many Hainanese emigrated abroad in search of a better life. Today, about 2 million Hainan Chinese are scattered in 53 countries worldwide.

In 1988, the island was made a special economic zone to boost foreign investment. The gross domestic product has increased tremendously, but economic development has gone through some boom-and-bust cycles. While rubber and agriculture are traditional industries, tourism, petrochemicals, biopharmaceuticals and machinery and electronic industries are expanding.

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## Haiti

**Map Page** 1137 **Area** 27,750 square mi (44,658 square km) **Population** 7,527,817 **Capital** Port-au-Prince **Highest Point** 8,792 ft (2,680 m) **Lowest Point** 0 m **GDP per capita** \$1,400 **Primary Natural Resources** bauxite, copper, calcium carbonate, gold.



HAITI IS LOCATED on the western third of the island of Hispaniola in the CARIBBEAN SEA. The country is mainly mountainous, with 60 percent of the land on gradients of at least 20 percent. The mountain ranges of Massif de la Hotte, the Massif de la Selle, and the Chaîne du Bonnet encompass much of the land. Two large peninsulas are present in the country. The peninsulas are separated by the Golfe de la Gonave.

The fertile river valleys and deep forests, which once provided beautiful sights, have diminished to a few. Haiti has suffered from deforestation, which has left only three percent of the land untouched. Much of the nutrient-rich topsoil has been washed away into the surrounding waters, which has destroyed some of the marine life. Because of the distinct range of elevations, the country has numerous plant species: 5,000 are spread throughout the land, including 600 fern and 300 orchid species. These plants thrive in the hot and humid climate throughout the year, with temperatures ranging from 65 degrees F (20 degree C) to 85 degrees F (30 degrees C).

The history of Haiti is full of turbulence. After almost 200 years of rule, SPAIN ceded the western portion of Hispaniola to FRANCE in 1697. This area named Saint Dominique soon became one of the wealthiest nations in the Caribbean. Sugar plantations arose throughout the nation, and slaves were brought over in large numbers.

In 1791, a slave revolt, led by Toussaint Louverture, broke out across the colony. Louverture named himself lieutenant governor of the state in 1796. How-

ever, in October 1801, after a victorious campaign in Europe, Napoleon ordered an expeditionary force to Haiti to reclaim its lost colony. By November 1803, the last of Napoleon’s forces were routed and on January 1, 1804, the war-ravaged colony was soon declared independent of French rule and renamed Haiti.

In 1844, Santo Domingo (soon renamed the Dominican Republic) declared its independence from the struggling country. Haiti seemed to be spiraling into obscurity in the world stage. From 1843 to 1915, 22 dictators ruled the country. In 1915, the UNITED STATES invaded Haiti hoping to create stability in the country. By 1937, the American troops left the country, with the belief that the country was a modernized and thriving.

For the next century, the Haitian government continued to struggle. During World War II, increased world market prices increased Haitian trade and greater exports. However, after the fighting ended, the country was still mired in poverty. François Duvalier was elected president of the country in 1957. Throughout his power, Duvalier struggled with the Catholic Church and citizens fleeing the country. He died in 1971, but his son, Jean-Claude Duvalier, took over the position. The Haitian economy continued to suffer and its external public debt increased to a staggering \$366 million in 1980. The Haitian people continued to flee.

During January 1986, urban resistance overspread the country, led in particular by Jean-Bertrand Aristide. On February 7, 1986, Duvalier left Haiti, and General Henri Namphy, with American support, took control of the country. The Haitian government continued to promise the United States that elections would occur in November 1987. Three years later, Aristide won the presidential election. He took office in early 1991 but was overthrown by a violent coup.

During this three-year period, a military de facto regime ruled the country and refused to return to a constitutional government. The United Nations ultimately passed a resolution and sent in a multinational force to restore order in the country. Before the American-led force actually stepped into the country, a deal was brokered, which the Haitian de facto government peacefully accepted. Aristide was returned to the country, where he became president and the constitutional government was restored under the watchful eye of the United Nations.

For the next 10 years, the international optimism surrounding Aristide slowly diminished. He became embroiled in a variety of corruptive practices and many questioned the fairness of the presidential elections. Opposition parties rose and by early 2003, violence

from all political sides began to flare up once again. In February 2004, Aristide fled Haiti, and afterward, U.S. Marines arrived along with 3,600 other international peacekeepers, to stabilize the situation. Haiti once again is trying to reestablish itself from its troubled past.

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## hammada

**HAMMADA** IS AN Arabic word used to describe "desert pavement." The deserts of the world that have sand dunes capture the imagination, but many of the world's desert areas are bleak, stony deserts. Usually, the stony deserts are level plains that are virtually devoid of vegetation and also have very little, if any, soil. These deserts can have a relatively smooth, rocky surface that is hard, like road paving. Hammadas form in regions where the soil is either saline or alkaline, with little ability to absorb water, and winds are strong.

Desert paving or hammada (North Africa) is called by a number of names in the different hot and cold deserts of the world. The names are banada, desert crust, deflation armor, desert armor (North America), desert pavement, GOBI (CHINA), gibber (AUSTRALIA), lag gravel or reg (Africa, if the fine material remains), serir (Africa, if no fine material remains) and stone pavement.

Hammada describes a dark, stony desert surface without sand or vegetation. The dark color is "desert varnish" caused by wind-borne clay particles that carry bacteria living on them. The particles coat the rocks of the pavement coloring them with a dark sheen.

Desert regions covered with hammada have a surface that is fairly smooth. The wind has blown away most of the sand, soil, and dust. A layer of rocks on bedrock has formed that is so tightly packed that it forms a solid surface. There may be a layer of soil or

dust under the hammada, but it can form directly on top of clean bedrock. The bare rocks that form hammada surfaces are usually relatively small and fit as tightly as a mosaic. Earth scientists describe these rock fragments as either primary or secondary. The primary stones are usually coarse, while the fine secondary material comes from the disintegration of the larger primary material.

There are several geomorphic theories explaining how hammada forms. One theory is that the pavement is a lag deposit. This theory says that the rock fragments of the pavement are what remains after the wind has blown away (deflated) all the small, fine-grained sand and dust. A second theory argues that moving water has deflated all of the fine material, leaving the hammada material behind to form the desert pavement.

A third theory sees the cycles of wetting and drying of the material as the cause. The exact nature of the process is not fully understood. Some claylike soils expand when wet, which forces stones to move upward. Another theory says that salt acts like water does when it expands or contracts in the freezing or melting process to create a stony surface. Another theory is that hammadas are caused by chilling and heating, as mechanisms that push stones to the surface of the desert and keep them there. Another theory is that several physical processes move the fine particles of sand and dust down between the stones of the hammada surface.

Hammada has been found on ALLUVIAL FANS, in dry WADIS, in terraces, on plateaus, on plains, and on bedrock. It is believed that hammada is also on the surface of the windswept planet Mars. Since hammada forms in such varied deserts conditions, it may be that all the theories are correct explanations.

The surfaces of many hammadas are hard enough for planes to use as landing strips. Vehicles can travel across the more solid variety, but excessive use can cause dust to rise from particles below the hammada surface. In the Atacama desert of Peru, the ancient Nazca people used hammada to make enormous drawings.

Tank battle maneuvers and tank battles in North Africa, KUWAIT, and IRAQ have disturbed large areas of hammada, causing dust and sand dunes to form elsewhere. The damage to these deserts will take many years for nature to repair.

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## Hawaii

HAWAII IS a U.S. state located in the central PACIFIC OCEAN near the EQUATOR and consists of eight major islands: Hawaii, Maui, Kahoolawe, Lanai, Molokai, Oahu, Kauai, and Niihau; 129 smaller islands are also



The high cliffs and rough coasts of Hawaii are a result of the volcanic origin of the Pacific Ocean islands.

part of Hawaii. Hawaii is not the equivalent of the Hawaiian Islands or the Hawaiian Chain, which includes other islands, such as Midway, that are not part of the state of Hawaii. At its greatest expanse, Hawaii extends for 1,523 mi (2,600 km); it has a total land mass of 6,423 square mi (16,729 square km). The highest point is Mauna Kea at more than 13,796 feet (4,205 m) and the lowest point is at sea level. The capital city is Honolulu on the island of Oahu. The population of Hawaii is 1,211,537 (2000 census), and its largest city is Honolulu (876,156). The state population is evenly divided by gender and has a density of 188.6 persons per square mile. The median age in 2000 was 36.2 years.

The island of Hawaii is the largest of the islands and has two active volcanoes, Mauna Loa and Kilauea; it supports extensive agricultural activity. Maui is called the Valley Island because of the dominance of two volcanic mountains; while a haven for tourists, Maui also has sustained valuable production of sugar. Kahoolawe is a small, uninhabited island near Maui. Lanai is the center of the pineapple business. Molokai, also near Maui, is an island of canyons and mountains; its central region is fertile for crops. Oahu has two mountain ranges, the Koolau Range in the east and the Waianae Range in the west. While supporting an expanding metropolitan Honolulu, Oahu is an agricultural center with sugar and pineapple plantations. Kauai, known as the Garden Island, is rugged; its Mount Waialeale has the greatest rainfall (460 in or 1,168 cm) per year on Earth. Niihau is rather arid; it is privately owned by the Robinson family of Kauai.

Hawaii's gross state product in 2000 was \$39.1 billion. The economy is based on tourism (\$10.9 billion), U.S. military defense spending (\$4.4 billion), and the sugar and pineapple businesses (\$276.1 million.) The Hawaiian state government is interested in diversifying the economy and has invested in developing science and technology, film and television production, sports, oceanic research and development, education, and floral and specialty food products. In trade, Hawaii transacted \$3.31 billion in merchandise in 2000 and had exports totaling \$407.7 million. Imported petroleum products provide more than 90 percent of Hawaii's energy requirements (2000).

Originally settled by Polynesians more than 1,500 years ago, Captain James Cook was the first European to visit Hawaii (1778). During the 19th century the native Hawaiian population (estimated about 300,000) was decimated by diseases imported by European and American adventurers, businessmen, and missionaries.



By 1900, the native population had been reduced to about 70,000. During the same time, American immigrants overthrew the native government and moved Hawaii to annexation by the UNITED STATES. American expansion in Hawaii and the PHILIPPINES was denounced as imperialism; for the most part, American culture absorbed Hawaiian culture, although recent years have witnessed a resurgent native Hawaii culture. Americans viewed Hawaii as strategically and economically significant; the American navy centered its Pacific headquarters in Hawaii, and American businesses reaped profits from sugar, pineapple, and other fruit products. The attack on Pearl Harbor and the subsequent war against Japan led to an expanded American presence in the Pacific.

During the second half of the 20th century, the United States relinquished its naval bases in the Philippines and became dependent upon Hawaii as the focal point for its Pacific fleet. Further, the naval observatories on Hawaii are important astronomical centers for research and satellite management.

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## Heard and McDonald Islands

TWO OF THE MOST isolated spots on the globe, the Heard and McDonald Islands have only been visited a few times, and much remains to be discovered about them. The islands are located at the bottom of the world, where the INDIAN OCEAN meets the Antarctic seas, and have recently been declared a United Nations UNESCO World Heritage site due to their pristine natural habitat, nearly untouched by human hands.

The first sighting of the larger island, Heard, is attributed to the British captain Peter Kemp in 1833, but also to the American captain John J. Heard, in 1853. Much smaller McDonald island, 27 mi (43.5 km) to the west, was spotted a year later by British captain William McDonald. Hunters, in the 1850s to 1870s,

nearly depleted the islands of their population of varieties of seals (notably elephant seal and fur seal), king penguins and whales, but these populations have now mostly returned to their former numbers. To further protect this wildlife, the government of AUSTRALIA established the Heard Island and McDonald Islands Marine Reserve in 2002. Thirty-four species of bird come here to breed, including penguins, albatrosses, and giant petrels. Human visitors are tightly restricted to occasional scientific expeditions.

The islands, about 1,000 mi (1,700 km) off the coast of ANTARCTICA, are the most volcanically active in the sub-Antarctic region. They are rises on the Kerguelen Plateau, which also includes the Îles Kerguelens, about 434 mi (700 km) to the northwest (territory of FRANCE). Neither of the islands has much vegetation, though kelp is abundant offshore. Rain or snow and extensive cloud cover keep the islands very wet most of the year and are accompanied by nearly constant high winds. Heard Island is a circular volcanic cone, dominated by the Big Ben Massif topped by Mawson Peak, the only active volcano in Australian territory. A mountainous headland extends 6.2 mi (10 km) to the northwest (Laurens Peninsula), connected by a narrow ridge little more than 330 ft (100 m) wide. Heard is surrounded by numerous outlying rocks, islets and reefs. A few kilometers offshore are the Shag Islands.

About 80 percent of Heard is glaciated, with ice up to 495 ft (150 m) deep. Ice cliffs make up much of the coast, adding to the island's inaccessibility. The McDonald Island group is made up of one volcanic peak and several smaller rocky islets (Flat Island, Meyer Rock).

Much smaller than Heard, McDonald has been landed on only twice in its history, and very little is known about it. In fact, the size of McDonald seems to have recently doubled—from .39 square mi (1 square km) to an estimated 1 square mi (2.45 square km)—through a volcanic eruption sometime between 1997 and 2001, when changes were detected on a satellite photograph. It is believed that this eruption is continuing, radically altering the shape of McDonald Island.

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## heartland

THE HEARTLAND THEORY was developed by Scottish geographer, Sir Halford J. MACKINDER. He read his paper "The Geographical Pivot of History" before the Royal Geographical Society in London in 1904, and soon afterward published his views on the influence of geography on politics in the *Geographical Journal*.

Mackinder's argument introduced into POLITICAL GEOGRAPHY the view that the globe could develop into two power blocs. The center of world power lay in the "heartland." This was roughly the territory east of the DANUBE RIVER to the URAL MOUNTAINS. Mackinder claimed that whoever unified and dominated Central and Eastern Europe would be able to control the three continents of the "World Island"—Europe, Asia, and Africa. His hypothesis, which became famous, was: "Who rules Eastern Europe commands the Heartland. Who rules the Heartland commands the World Island. Who rules the World Island commands the world." The other power bloc, because of what he viewed as the relative decline of sea power, was the "maritime lands."

Mackinder had rejected the theory of sea power as the key to world domination proposed in *The Influence of Sea Power upon History* by Captain Alfred T. Mahan of the U.S. Navy. Mahan developed a number of factors of state power, such as geographical position, extent of territory, population, and national and governmental character to explain state power. Mahan had used his study to propose policies for the American government to follow. These included annexing the Hawaiian Islands, controlling the CARIBBEAN SEA, and building a canal across PANAMA. Theodore Roosevelt was to use these ideas as the basis of his foreign policy.

In contrast, Mackinder claimed that land-based power was increasing in scope because of improvements in communications, transportation, and armaments. The heartland power would be the ultimate land power that would be impossible to expel from its natural fortress. He believed that there was a Eurasian core that would be impregnable to naval power. As the center of a great fertile landmass, it would be difficult to penetrate with sea power and easily defended with land forces.

Mackinder's views were read and discussed by many people immediately. His hypothesis soon became one of the most intensely debated ideas in the history of geography. Mackinder's views were eagerly accepted by a number of German politicians. In particular by Karl Haushofer, who with others adopted a *geopolitik*

program. Their views influenced Adolf Hitler, who used them as a rationale for conquering Europe.

Among those who disagreed with Mackinder's theory was N.J. Spykman. He argued that Mackinder had exaggerated the Heartland's potential for power. The real power was not in the "pivot," as Mackinder had termed the heartland, but in what Mackinder had called the "inner crescent" or the "rimland" in Spykman's terminology. Spykman's hypothesis became, "He who controls the Rimland rules Eurasia; Who rules Eurasia controls the destinies of the world."

Missing from the heartland theories of Mackinder and Spykman was air power. In 1943 Mackinder dismissed air power as a technological change that would make a difference in the balance of power. However, in 1950 A.P. de Seversky argued that the key to American survival and supremacy was air power.

Another critic of Mackinder was A.R. Hall. In 1955, Hall argued that Mackinder had ignored the existence of another "heartland," namely the Anglo-American alliance.

In 1956, D.W. Meinig proposed changes to Mackinder's heartland theory and to the rimland theory. His criticism included changes to the definitions and criteria of Mackinder's theory. In 1964, D.J.M. Hooson extended the heartland theory by identifying the "core" areas, such as the industrial centers.

In the last quarter of the 20th century, two major groups debated and extended Mackinder's ideas. The first group was composed of specialists in strategic studies. One important representative of this approach was Colin S. Grey, who published *The Geopolitics of the Nuclear Era* (1979). The other group was composed of scholars in traditional POLITICAL GEOGRAPHY. These included authors such as Geoffrey Parker (*Western Geopolitical Thought in the Twentieth Century* 1985), among others.

After World War II, the Soviet Union effectively controlled the heartland. Mackinder, however, had proposed ideas of an Atlantic community in 1924 that developed into the NORTH ATLANTIC TREATY ORGANIZATION (NATO). In addition the Cold War policy of containment of communism was, in effect, a siege of "fortress" heartland. Global politics of the 20th century were deeply influenced by Mackinder's geopolitical vision. The War on Terror is also being waged with a geopolitical eye on the Middle Eastern "rimland."

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## hemisphere

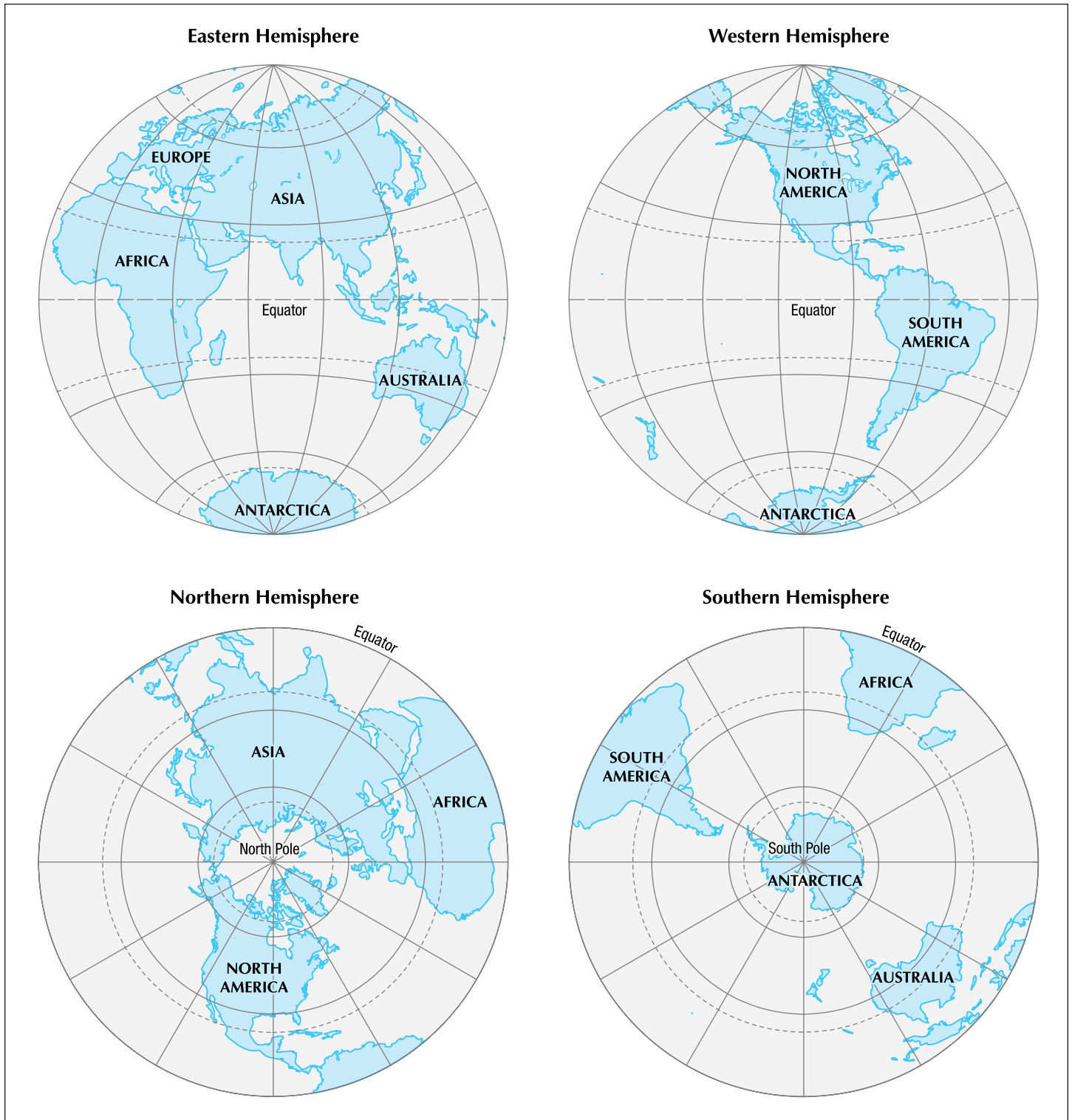
THE WORD *hemisphere* means "half a sphere." In geography, the term refers to half the Earth, and the enclosing boundary line of a hemisphere is a great circle. A space traveler viewing the Earth from a great distance will see only half the earth, a hemispheric perspective. This is true because the Earth is a sphere and only one side of the Earth can be seen in any one particular view.

Our only look at the entirety of the Earth's surface is through world maps. The map view of the world is important for that reason despite the fact that every map 1) is a scaled-down replica of the Earth, 2) presents a generalized view of the Earth's surface, and 3) is a distortion of the Earth's surface to varying degrees. There are an infinite number of possible hemispheric views of the Earth. When an observer looks directly at any particular point on the Earth's surface, a hemisphere is defined. However, there are a number of hemispheres that have special importance for the discriminating viewer. For instance, if the equator is the great circle enclosing a hemisphere, the viewer will be

seeing either the Northern Hemisphere or the Southern Hemisphere. In both cases, the center of the hemispheric view will be one of the poles. Viewing the Southern Hemisphere would show vast expanses of the southern oceans, interrupted by the southern extremes of South America and Africa, about half of AUSTRALIA, all of NEW ZEALAND, and a few scattered islands in the PACIFIC OCEAN. In the center of the view would be the geographical South Pole and the continent of ANTARCTICA, a true landmass covered by heavy sheets of ice. For example, South Pole station sits on ice that measures 8,000 ft (2,438 m) in thickness. The presence of a preponderance of water in the Southern Hemisphere has a great impact of the climate in this region. Since large water bodies do not heat up and cool as quickly as comparably sized land areas, the annual changes in temperature are much lower.

The view of the Northern Hemisphere is distinctly different. At the center of the view is the geographical North Pole, a point that is impossible to permanently mark on the surface because of the constant movement of the ice on the Arctic Ocean. South of the pole are the northern regions of the great landmasses of the northern hemisphere. Particularly imposing in this regard is the longitudinal sweep of Eurasia extending over 180 degrees of longitude. RUSSIA alone boasts of having 11 time zones. The northernmost reaches of North America are also prominent in this view, its land area bracketed by the ATLANTIC and PACIFIC oceans. The climatic impact of the presence of large land areas in the Northern Hemisphere is profound. The variability in annual temperatures is extreme in this region. It is not uncommon for areas within the continents of Eurasia and North America to have average winter temperature near 0 degrees F (-17.7 degrees C) and summer averages in the 70 and 80 degrees F (21 to 26 degrees C) range, temperature ranges not found in the southern hemisphere.

Familiar to everyone are the Eastern and Western Hemispheres. The two are separated by a great circle comprising two longitude lines, both running from pole to pole in opposite directions. The longitude line designated 0 degrees passes through Greenwich, England, and serves as one of the dividers between the two hemispheres. Its counterpart passes through the Pacific Ocean 180 degrees from the prime meridian. Hence, it is identified as longitude 180 degrees. An observer standing at any location along either of these lines is on the boundary between the eastern and western hemispheres. The prime meridian is the conventional starting point for assigning degree values to longitude lines.



The area west of the prime meridian to longitude 180 degrees is the Western Hemisphere. Conversely, the area to the east of the prime meridian is the Eastern Hemisphere. The longitude lines in both hemispheres are measured in degrees from the prime meridian. Time zones are also directly related to the 360 degrees of

longitude. The time of day increases east of the prime meridian one hour for every 15 degrees of longitude. On the other hand, the time of day decreases west of the prime meridian one hour for every 15 degrees of longitude. The longitude line at 180 degrees is identified as the INTERNATIONAL DATE LINE. A traveler cross-



ing the International Date Line in an easterly direction and entering the Western Hemisphere would then be in the previous day. On the other hand, travelers going from the Western Hemisphere into the Eastern Hemisphere would find themselves in the next day. Although 180 degrees longitude designates the International Date Line, the line is displaced to the west at one point in order to include the Aleutians and keep all of Alaska in the same day. Similarly, the line is displaced to the east in the southern Pacific Ocean to include the Cook Islands in the same day as Australia and New Zealand.

Two additional hemispheric views illustrate the land and water hemispheres. If a globe is oriented so that the Cook Islands in the South Pacific are in the center, the water hemisphere may be seen. This is the hemisphere that has the maximum amount of water in view. In addition to a few islands in the South Pacific, the only land areas visible are portions of Australia, Antarctica, and South America. All of New Zealand is seen. The water hemisphere perspective clearly illustrates the enormous extent of the Pacific Ocean.

If the globe is oriented with the country of Turkey in the center, then the land hemisphere comes into view. In this perspective the viewer is seeing the hemisphere that has the maximum land area. The entire continent of Africa is present as well as South Asia, Europe, and a large part of the Asian landmass to the east. In addition, the eastern portion of North America is in view.

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## Himalayas

THE HIMALAYAN mountain region, located between INDIA and TIBET, has the world's highest peaks. It stretches from the INDUS RIVER in the west to the Brahmaputra in the east and has a length of 1,500 mi (2,414 km) and a width from 100 to 150 mi (161 to 241 km). Northwest of the Indus, the region of mountain ranges that extends to a junction with the Hindu Kush, south of the Pamir range, is known as Trans-



*The Himalayan mountain range, separating India and China, has the highest peaks in the world.*

Himalaya. Thus, the Himalayas represent the southern face of the great central elevated region—the plateau of Tibet—the northern face of which is buttressed by the Kunlun.

The physiography of the Himalayan mountain system can be classified into three parallel longitudinal zones:

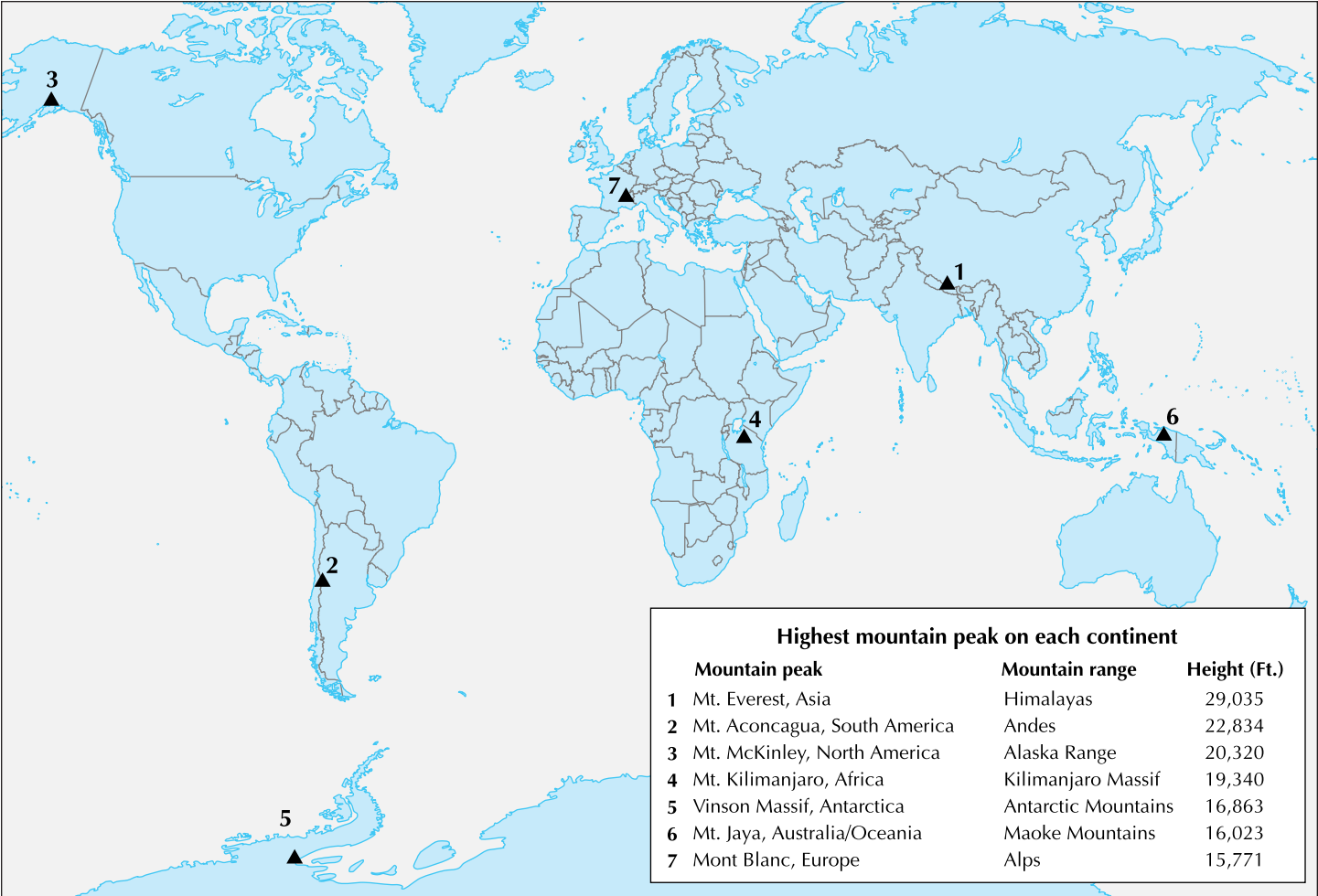
**The Great Himalayas.** The main ranges, which lie in the north, rise above the snow line and have an average elevation of 20,000 ft (6,096 m) above sea level. They include the highest peaks of EVEREST (29,035 ft or 8,850 m), K2 (Godwin Austen) (28,251 ft or 8,611 m) and Kangchenjunga (28,168 ft or 8,586 m).

**The Lesser Himalayas.** The middle ranges, which are closely related to and lie south of the Great Himalayas, form an intricate mountain system with an average height of 12,000 to 15,000 ft (3,657 m to 4,572 m) above sea level.

**The Outer Himalayas.** These comprise the Siwalik and other ranges, which lie between the Lesser Himalayas and the plains and have an average height of 3,000 to 4,000 ft (914 to 1,219 m) above sea level.

The above classification is a useful generalization but does not represent the peculiar and complex features of the Himalayan system. These include:

**The Great Northern Watershed.** On the north and northwest of Kashmir is the great water divide, which separates the Indus drainage area from that of the Yarkand and other rivers of Chinese Turkistan



Principal mountains							
Mountain peak	Location	Meters	Feet	Mountain peak	Location	Meters	Feet
1 Everest	Tibet-Nepal	8,850	29,035	17 Muztagh Ata	China	7,546	24,747
2 Godwin-Austen (k2)	India	8,611	28,250	18 Pik Kommunizta	Tadjikistan	7,495	24,590
3 Kangchenjunga	Nepal-India	8,586	28,170	19 Pobedy	Kyrgyzistan	7,439	24,406
4 Makalu	Nepal-India	8,463	27,766	20 Chomo Lhar	Myanmar	7,313	23,992
5 Dhaulagiri	Nepal-India	8,167	26,795	21 Lenina	Kyrgyzistan	7,134	23,405
6 Nanga Parbat	Pakistan	8,125	26,657	22 Api	Nepal	7,132	23,399
7 Annapurna	Nepal	8,091	26,545	23 Acongagua	Argentina	6,960	22,834
8 Gosainthan	Tibet	8,012	26,286	24 Ojos Del Salado	Argentina	6,908	22,664
9 Nanda Devi	India	7,816	25,643	25 Tupangato	Argentina-Chile	6,801	22,310
10 Kamet	India	7,756	25,446	26 Mercedario	Argentina	6,770	22,211
11 Namcha Barwa	Tibet	7,756	25,446	27 Huascaran	Peru	6,769	22,205
12 Gurla Mandhata	Tibet	7,728	25,355	28 Llullailaco	Chile	6,723	22,057
13 Kongur	China	7,720	25,325	29 Neradas De Cachi	Argentina	6,720	22,047
14 Tirich Mir	Pakistan	7,691	25,230	30 Kailas	Tibet	6,714	22,027
15 Minya Konka	China	7,556	24,790	31 Incahuasi	Argentina	6,709	22,011
16 Kula Kangri	China	7,555	24,784				

(Sinkiang). It is not the great Himalayas but the Muztagh range which, with the Karakoram mountains, trends southward, forming a continuous mountain barrier and the true water divide west of the Tibetan plateau.

*Eastern Tibet.* The Tibetan plateau, or Chang, breaks up at about the meridian of latitude 92 degrees E, to the east of which the affluent of the Tsangpo (the Dihang and subsequently the Brahmaputra) drain from wild, rugged mountain slopes. In this region are

the sources of all major rivers of China and Myanmar (Burma).

It is now proved that Mount Everest, which appears from the Tibetan plateau as a single dominating peak, has no rival among Himalayan altitudes and is definitely the world's highest mountain. Everest was climbed by Sir Edmund Hillary and Tenzing Norgay in 1953. In Asia, there are 94 peaks exceeding 24,000 ft (7315 m); all but two are in the Himalayas or Karakoram.

Much of the Himalayan area is still very imperfectly known geologically. The general structure resembles that of the Alps, with huge overfolds and nappes; all the main horizons from Precambrian to recent appear to be represented. A very large number of rock groups have been distinguished, described, and given local names. It is certain that during Mesozoic times, the Himalayan area was occupied by the great geosyncline, which coincided with the Tethys Sea or ocean basin. The sediments laid down in the Tibetan section of this great basin constitute the Tibetan zone, in which fossiliferous beds of Paleozoic and Mesozoic ages differ entirely in facies from those farther south. The second or Himalayan zone, which comprises the Great and Lesser Himalayas, is composed chiefly of metamorphic rocks and sediments that are generally unfossiliferous. It is believed that the elevation of this central axis took place mainly in Eocene-Oligocene times and that during this phase the important nummulitic limestones were deposited in a series of basins, notably in Ladakh. The main orogeny would seem to have resulted from the northward movement of the ancient block that is now seen in peninsular India and that underlies the Indo-Gangetic plain. Continued movement in Miocene times folded the nummulitic limestones; the final phase of the mountain building came in post-Pliocene times and has scarcely yet ceased—as the Assam earthquake bears witness—and folded intensely the Pliocene Siwalik sediments of the southern flank of the Outer Himalayas.

The uplift of the Himalayas was a gradual process protracted over a very long period and had a very marked effect upon the scenery, the topography, and the river system. The last is not consequent upon the structure, but the principle rivers were of an age anterior to the tertiary earth movements and the drainage is spoken of as antecedent. During the slow process of uplift, folding, and faulting, the rivers were able to keep, for the most part, to their original courses, although their erosive power was increased because of increased gradients.

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## Hindu Kush

HINDU KUSH (or Hindukush) is the main mountain range in the Central Asian state of AFGHANISTAN. Hindu Kush is the westernmost extension of the Pamir mountain, the Karakoram (K-2), and the western HIMALAYAS.

The origin of the term *Hindu Kush* (which translates as "Hindu Killer" or "Killer of Hindus") is a point of controversy among scholars. Three possibilities have been put forward in this context. One, the mountains concerned are tribute to Indian slaves who perished in the difficult mountainous terrain while being transported from India to slave markets of Central Asia. Two, the name is merely a corruption of Hindu Koh, the pre-Islamic name of the mountains that divided Hindu-populated southern Afghanistan from non-Hindu northern Afghanistan. The third possibility is that the name is a posited Avestan appellation meaning "water mountain."

The mountains of the Hindu Kush system diminish in height as they stretch in a westward direction. Toward the middle near Afghanistan's capital city Kabul, they extend from 14,763 to 19,685 ft (4,500 to 6,000 m); in the west, they attain heights of 11,482 to 13,123

ft (3,500 to 4,000 m). The average altitude of the Hindu Kush is about 14,700 ft (4,500 m). The Hindu Kush mountain range stretches about 600 mi (966 km) laterally, and its median north-south measurement is about 149 mi (240 km). Only about 373 mi (600 km) of the Hindu Kush system is called the Hindu Kush mountains. The rest of the system consists of numerous smaller mountain ranges, including the Salang, Koh-e-Baba, Koh-e-Paghman, Spin Ghar, Sian Koh, Suleiman, Selseleh-e-band-e-Turkistan, and Koh-e-Khwaja Mohammad. The western Safid Koh, Doshakh and the Siah Band are known as the Paropamisus by scholars of Central Asia. Three rivers flow from the Hindu Kush mountain range, namely the Helmand River, the Hari Rud, and the Kabul River that also provide water to major cities and regions of Afghanistan.

Huge caravans pass through high passes (*kotal*) transecting the mountains. The most important mountain pass in the Hindu Kush range is the Kotal-e-Salang, which links Kabul and points south to northern part of Afghanistan. Before the Salang road was constructed, the most famous passes in the Hindu Kush region were the Khyber Pass (3,369 ft or 1,027 m) and the Kotal-e-Lataband (8,199 ft or 2,499 m). The roads through the Salang and Tang-e-Gharu passes are critical strategic routes between Afghanistan and RUSSIA and other old Soviet republics.

The Hindu Kush is sparsely populated and inhabitants subsist year-round on livestock and crops. The Kalash people are one of the main inhabitant groups of Hindu Kush and claim to be descendants of Alexander the Great. They have their own distinctive laws, religion, and culture.

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## hinterland

FROM THE GERMAN *umland*, a hinterland is inland territory behind and bordering a town on a coast or

river, or the backcountry extending from an inland town. In both cases, the hinterland generally falls under the legal and economic jurisdiction of the same state to which the city belongs. The hinterland supplies a city with food, fuel, raw materials and, in the modern period, labor. It also serves as a market for its manufactured goods and services. The flow of goods and services between the hinterland and city is facilitated by a communication infrastructure of roads, canals, and bridges.

The development of the hinterland is connected with the rise of cities, appearing first with ancient Mesopotamian ceremonial and administrative centers, whose population specialized in the maintenance of ritual, on the one hand, and trade or redistribution, on the other hand. Because the center's population was occupied primarily with non-food producing activities, it depended entirely for its food and fuel on its agricultural hinterland. The size and prosperity of a ceremonial and administrative city, therefore, depended on the agricultural productivity of its countryside, and tributary relationships were developed to control its resources.

A city that also engaged in long-distance trade, such as the polis of classical Greece (5th to 4th centuries B.C.E.), was less dependent on its hinterland if food could be obtained from farther afield. With expanding trade and a rise in population, the polis outstripped its hinterland's capacity for food production. The hinterland of classical Athens, Attica, was suited to the cultivation of olives and grapes, used in the production of olive oil and wine, which then were exchanged for grain from the Greek BLACK SEA colonies. Similarly, Quanzhou, a metropolitan port city in Southeast CHINA's Quannan region, served as one of the main trading centers in the South China Sea and Southeast Asia from 1000 to 1400. With Quanzhou's rapid expansion in the 11th and 12th centuries, its agriculturally weak backcountry, the Fujian hinterland, made the transition from food cultivation to that of cash crops such as lichee, sugarcane, and cotton and the manufacture of ceramics and metal products.

This commoditized city-hinterland relationship therefore served to include Greek and Chinese farmers on marginal arable lands in the international market. Additionally, premodern trading centers that lacked even agriculturally poor hinterlands, such as Timbuktu in West Africa or many of the early medieval coastal trading sites in northern Europe, either declined or were abandoned altogether when trade routes shifted away from these centers.



Even an agriculturally rich hinterland benefited from its relationship with the city. For example, the introduction of more animals to provision estates and pull the recently invented carriages of the elite in 17th- and 18th-century PARIS meant that more fodder had to be brought to the city. Hinterland peasants responded by planting fields with more oats and meadows with forage crops, delivering these products to the city and carting away the manure from urban stalls, which they would use in turn to fertilize nitrogen-poor fields. Paris basin hinterland farmers thus took advantage of the opportunities offered by economic changes in their core region and thus generally fared better than the outland French peasantry.

### MODERN ADAPTATIONS

In the 19th and 20th centuries, metropolitan hinterlands encountered further adaptations with the growth of long-distance transportation networks, communication, industrialization and banking. As with classical Athens, modern LONDON's south English hinterland is poorly equipped to feed the metropolis, but as a major financial center, London is able to import its food from distant mainland markets. Like Attica, London's lowland backcountry takes part in the long-distance market, using the revenues from its industries to purchase imports.

Third-world hinterlands, in contrast, suffer from slow technological development and poverty, resulting in the migration of the hinterland population to metropolises such as KOLKATA (CALCUTTA), which cannot support such a large population. A final example of a metropolitan hinterland is designated by the U.S. Census Bureau's term the Metropolitan Statistical Area (MSA), comprising three zones: the city, bounded by its corporate limits; an urbanized area contiguous to the city; and a nonurbanized area economically connected to the metropolis.

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## historical geography

GEOGRAPHERS SEEK TO understand the world by examining spatial relationships. The types of questions they might ask are: Why are things located where they are? How are places different from each other? How are places like each other? How are places interconnected with each other? How do people affect their natural environment and how does the natural environment affect people? In many instances, the answers to these questions are related directly to what the world is like today.

For historical geographers, these questions are adapted to consider the role of time. For example, a historical geographer might ask questions such as: How did people, things, and landscape elements come to be located where they are? How did a place come to be like other places? How did it develop differently from other places? How have people been affected by the natural environment? How have they altered the environment as well? In short, historical geography might be described as the study of past places.

Some of the earliest attempts at what might be considered historical geography are rooted in ancient GREECE. Although typically identified as a historian, Herodotus has often been regarded by geographers as one of their own. Based upon his own extensive travels and keen observations, Herodotus developed a sophisticated understanding of how the processes of physical geography played out over extended periods of time, resulting in what was his contemporary landscape.

While individual travel and exploration aided in the development of the historical geographies of Herodotus, the expansion of Islam further developed the field of historical geography. By the mid-8th century C.E., religious conquests had brought northern Africa and the Iberian Peninsula under Islamic control. What transpired was an exchange of ideas between East and West. At the same time, Muslim concepts such as the use of the decimal system made their way into Europe, and Greek and Roman texts were translated into Arabic for the first time. Like the Greeks, Muslim scholars such as Al-Biruni incorporated the role of time within the processes of physical geography. In his study of India, Al-Biruni attempted to explain the formation and distribution of alluvial deposits, predating the development of similar ideas in Europe by centuries. Considered perhaps the most significant historical geographer of the medieval Muslim world, Ibn-Khaldun has been cited as the first to explicitly link the physical environment to human activity and culture

through time—thereby establishing the human-environment connection so crucial to the broader field of geography as well.

Nineteenth-century European historical geographers continued to study the relationship between humans and the natural environment with respect to time, but were furthered in their research by theoretical developments in the biological and social sciences. In 1859, Charles Darwin introduced the notion of natural descent in his historic volume, *The Origin of Species*. Drawing in part upon Thomas Malthus's ideas concerning population growth and the limitations of the natural environment, Darwin concluded that environments were capable of supporting a limited number of organisms and only those organisms best biologically suited to an environment would be able to remain in that environment and successfully reproduce. Those less well suited to the environment would ultimately face extinction because of competition from better adapted organisms.

### SOCIAL DARWINISM

Although Darwin himself did not specifically include humans within his understanding of evolutionary processes, other scholars like English philosopher Herbert Spencer would. Called social Darwinism, the work of Spencer (who coined the phrase “survival of the fittest”) drew parallels between human and animal societies and their relationships to the natural environment. Over time, humans had adapted to their natural environments.

But as historical geography would suggest, natural environments were always changing as well and humans would once again have to adapt or face extinction. Social Darwinism expanded these ideas to include not only the natural environment, but also the social environment. Only those people best adapted to the natural environment and how society had altered and organized itself would thrive and prosper while those not who were unsuccessful in their struggle for survival would eventually die out with time.

Evolutionary ideas like those of Darwin and Spencer were eventually incorporated into the work of historical geographers. German geographer Friedrich Ratzel has often been described as having been greatly influenced by the notion that human societies, like organisms, struggle to survive in specific natural environments. Ratzel suggested that states develop throughout history within the particular constraints of natural environmental resources, including space itself. When the population of a state begins to exceed or meet the ca-

capacity of these resources, it must expand its boundaries or be destined to go into a stage of decline and be threatened by more expansive and powerful states. Such expansionist theories of how the history of states was affected by the geography of a territory marked an advancement not only in historical geography, but likewise in the study of migration and geopolitics.

### HEARTLAND THEORY

Originally trained in the natural sciences like Ratzel, English geographer Halford J. MACKINDER also tied human culture and political organization through time to the environment. Through his heartland theory, Mackinder suggested that world history could be explained through an examination of the resources and accessibility of various natural environments. Prehistoric humans, he claimed migrated out of the “heartland” to other parts of the globe. Control of the strategic heartland then, had and would continue to dictate who held dominion over the rest of the world.

Just as Ratzel and Mackinder discussed historic diffusion of population and its impact on global politics past and present, European contributions to the field of historical geography diffused across the ATLANTIC OCEAN to the UNITED STATES as well. The influence of Ratzel is especially evident in the work of one of his American students: Ellen Churchill Semple. Although she served as the first female president of the Association of American Geographers in 1921, Semple is most typically remembered for her role as an environmental determinist.

Environmental determinism suggested that the cultural characteristics of a human society would largely evolve according to the physical geography of the group's home territory. As a result, some groups of people in the world were declared predisposed to immorality and laziness as a result of long-term exposure to tropical climatic conditions or because they lived in along mountain passes. Conversely, other groups, most notably those of Northern Europe, were deemed more successful due to the manner in which their physical environment challenged them and contributed to admirable cultural traits. Environmental determinism allowed for the integration of evolutionary history, culture, and physical geography.

Although much of Semple's work falls within the classification of environmental determinism, it also at times backs away from being absolutely deterministic. Semple suggested that while environmental conditions may influence people's actions and livelihoods, they cannot explicitly control people. Environmental condi-

tions may restrict or enable certain ways of life, but ultimately people make their own choices as to how to react to these situations. According to Semple, people did, however, tend to react to specific environments in predictable ways that could be described in terms of spatial patterns of behaviors and corresponding environments.

A contemporary of Semple, geologist Albert Perry Brigham, also began his career in historical geography by examining the role of environmental influences upon society. Later in his career, however, Brigham criticized fellow geologists and geographers who studied this link between humans and the environment, but failed to approach the matter scientifically. He criticized environmental determinists for creating broad generalizations concerning the effect of the environment upon culture that were not based upon scientific evidence but were rather descriptive accounts. Specifically, Brigham rejected their attempts to explain human society based solely upon climatic influences. The natural environment, he explained, was far too complex for geographers to be able to isolate singular environmental characteristics as the historical root cause of race, character, or culture.

Human adjustment to the physical environment through time continued as a primary area of focus after World War I with the work of Harlan H. Barrows. Through the development of the subfield of human ecology, Barrows redirected the emphasis of environmental determinists upon physical environmental controls toward a human-centered approach. Human ecology sought to understand the impact of humans upon the earth through time rather than merely the impact of the earth upon humans.

## CHOROLOGY

An even stronger rejection of environmental determinism in American geography was led by Carl O. SAUER in the 1920s. For Sauer, the primary purpose of geography should be chorology, or the study of areas. Rather than constrain geographers within the limits of environmental influences, geography should study places in terms of regular characteristics that tied them together. These regularities could then be analyzed to understand how areas differ as well as how they are interconnected.

For Sauer, one important way of classifying areas was the cultural landscape. Drawing upon both human ecology and chorology, geographers like Sauer examined how humans transformed the physical environment of the Earth to make it suitable for their own

needs. What remained was an imprint of human habitation: the cultural landscape. At times, practitioners of the cultural landscape approach to geography went so far as to challenge environmental determinist traditions by suggesting that human decision making was often a much greater determinant of location than were such physical geography components as climate, soils, and relief.

Chorology and the accompanying cultural landscape studies allowed for the explicit inclusion of history into geography. Cultural landscapes could be examined with regard to which people had lived in them and created them. From this trend emerged the work of geographers such as Derwent Whittlesey and his notions of sequent occupance. According to Whittlesey, a group of people that occupies a place leaves its cultural imprint upon the physical environment based upon its way of life. With the passage of time, preexisting groups must readapt the cultural landscape to meet their changing needs. Similarly, new groups to a location may also alter the preexisting cultural landscape to coincide with their society's needs and desires. What emerges in both instances is a succession of imprints upon the cultural landscape, each one in essence adding another layer to what the contemporary geographer sees. By working backward through time, a historical geographer could uncover each layer and come to understand how the past contributed to the creation of current cultural landscapes.

## METHODS AND RESOURCES

As the work of the early 20th-century scholars suggests, a key strength of historical geography lies within its ability to incorporate the notion of change. Historical geographers incorporate elements of the past to understand the present and future geographies. So how do historical geographers approach their work? What kinds of resources do they use?

Among the resources most used by historical geographers are archival documents, historic records of the past. Often these sources are stored by the government in national, state, and local archives; public and university libraries; as well as government offices. Examples of the type of information available in these locations include the original Federal Manuscript Census forms filled out over a century ago by hand; property ownership and land use records; natural resource inventories; and some of the primary tools of the trade for geographers—maps and photographs.

Maps and photographs have proven especially important for historical geographers who study the cul-

tural landscape. But equally important for them is the use of fieldwork that includes studying the landscapes as they are today. By looking at the material culture, or built environment, of a cultural landscape, the historical geographer may trace the elements back through history to understand what took place in the past.

For example, by studying the types of houses built or field patterns used, a historical geographer might be able to tie those elements back to another place in the world and in doing so uncover historic migration patterns. With that in mind, they might also attempt to relate the appearance of the cultural landscape to political, economic, or religious belief systems present in a society.

Fieldwork is also crucial for those historical geographers specializing in the transformation of the physical environment. After going into the field to take current measurements of physical phenomena such as river sediment discharge or inventory soil types, they can then compare those new measurements to those of the same places in past times. This process allows physical geographers to understand and chart historical change in the environment. Like cultural geographers, physical geographers may also combine fieldwork and archival documents in their work. Old maps, photographs, and even personal accounts of past environments can be used to fill in the gaps between time periods as well.

### HISTORICAL GEOGRAPHY TODAY

While the basic idea of historical geography as the study of past places remains today, the scale of those places and spatial relationships has grown considerably in more recent decades. One of the major areas of interest in historical geography today examines the process of globalization. Globalization describes how different places in the world are becoming more and more interconnected with each other every day. Many historical geographers are now interested in the history of geopolitics and the changes in world economies. By examining these systems at the largest scale possible, the global scale, historical geographers seek not only to understand how politics and economics impacted societies around the world in the past, but also to predict what new alliances and conflicts may arise in our future.

Migration studies are still vital to understanding the historical processes of globalization. In some instances, historical geographers examine migration patterns with the goal of trying to understand how countries such as the United States expanded as well as

how its settlers learned to adapt to new environmental challenges. While these historical geographers may focus on the progress of settlers and new nations, others may examine the issue of migration from the standpoint of the preexisting, or indigenous, population. Migration and settlement do not occur in empty space, but rather, in the case of colonialism, they affect the people who were already living in those places for centuries beforehand.

By understanding the changes that occurred with the development of colonialism centuries ago, historical geographers can hope to better explain the often difficult conflicts that emerge with the collapse of colonial empires in the 20th century.

This reexamination of colonialism from the perspective of native populations has also drawn attention to other groups whose stories have often been left untold. One area of historical geography that has grown substantially in more recent decades is one that focuses on feminist historical geography. Throughout history, women and men have often held different amounts of political, economic, and social power. Feminist historical geographers attempt to shed light on how these inequalities affected the way that women experienced historic events and places in dramatically different ways from men.

Modern technology has certainly aided in the practice of historical geography in more recent decades. With the development of cheaper and faster computing systems and the Internet, access to historic geographic data has grown substantially. Now, with only the click of a computer mouse, historical geographers can locate data sources on the Internet once available only on paper in archives. This turn to the digital world has also been reflected in the increasing use of geographic information systems (GIS) in historical geography. GIS often serves as a means for efficiently storing, retrieving, and analyzing historical spatial data that would have previously occupied thousands of printed volumes and taken thousands of hours to examine individually by hand. Understanding the past has certainly been aided by present technology.

Despite the centuries that have elapsed since the chronicles of Herodotus and Ibn-Khaldun, their work nonetheless still reflects ideas common to that of more contemporary geographers, even those using GIS. The goal of historical geography is not simply to provide a single snapshot image of past places, but rather, like these historic scholars, to come to understand how places of the past are related to those of today. Historical geography does not try to discover ultimate causes



or a single origin; rather, it recognizes that geographical relationships occur within a continuum of time—past, present, and future. Historical geographers attempt to reconstruct past places in the interest of understanding contemporary places and their potential impacts upon future ones.

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## Hokkaidô Island

**NORTHERNMOST** OF the four main islands of JAPAN, Hokkaidô is surrounded by the Sea of Okhotsk to the north and east, the Sea of Japan to the west, and the PACIFIC OCEAN to the south. Its northern location and frigid ocean currents from the Sea of Okhotsk make Hokkaidô's climate considerably colder and drier than the rest of Japan; the island is known for its long winters. Hokkaidô is about the size of IRELAND, and almost square in shape, roughly 186 mi (300 km) on each side.

Japan and RUSSIA dispute territorial jurisdiction over four small islands to the north of Hokkaidô (Etorofu, Kunashiri, Habomai, and Shikotan). Japan had exercised control over these islands until the former Soviet Union occupied them at the end of World War II. (Jurisdiction over the much larger island of Sakhalin, or Karafuto as the Japanese call it, is split between Japan and Russia.) Hokkaidô was only fully incorpo-

rated into Japan in modern times. Until the 19th century, most of Ezo (the previous name for Hokkaidô) was a wilderness, home to the indigenous Ainu people. Today, the population of Ainu in Hokkaidô has dwindled to about 16,000 from death and assimilation. Many place names in Hokkaidô are in the Ainu language, including the prefecture's capital, Sapporo, and cities such as Kushiro and Muroran.

Japan's Meiji government renamed the island Hokkaidô in 1869, set national borders encompassing the entire island as part of Japan, and encouraged settlers to move north. Yet Hokkaidô remains sparsely populated by Japanese standards. Its population of about 5.7 million is less than 5 percent of Japan's overall population. On the other hand, Hokkaidô's area of 30,315 square mi (78,515 square km) makes it the second-largest island in Japan (after Honshû). The large area of Hokkaidô combined with its relatively small number of inhabitants yields a population density of 186 persons per square mi (72 persons per square km), only about one-fifth the national average.

The forests of Hokkaidô produce lumber and forest products, and the island is the largest source of coal in Japan, followed by southernmost major island of Kyûshû. The waters around Hokkaidô are rich sources of fish (including the local specialty of crab). Agriculture is another important part of the economy, and Hokkaidô provides much of Japan's food, including potatoes, onions, beans, wheat, and milk and other dairy products. Although the climate is far less suited to wet paddy field agriculture than lands to the south, new seed types permit the growing of rice, the single largest crop in Hokkaidô. In contrast to most of Japan, Hokkaidô has many dispersed farmsteads, with much larger farms, and employs far more draft animals. Parts of Hokkaidô resemble New England, with broad fields, rolling hills, and grazing cattle.

Tourism is another important part of the economy in Hokkaidô. The island is home to several large national parks, with clear deep lakes, snowy mountains, and unspoiled forests. The first Winter Olympics to be held outside Europe or the United States were hosted by Sapporo in 1972. Every February since 1950, Sapporo has also held an annual Snow Festival, featuring ice sculptures and snow statues; the festival attracted 2 million visitors in 2003.

Development of Hokkaidô has lagged behind the rest of Japan, in part because of the isolation of this northern territory and its separation from the main island of Honshû by long distances and the Tsugaru Strait. In 1988, the Seikan Tunnel linked Hokkaidô

with Honshû by underground rail, and the Bullet Train (Shinkansen) now has its northern terminus in Hokkaidô. Yet because of the distances involved, air travel remains a common route to Hokkaidô.

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## homeland security

AS DEFINED BY the executive branch of the U.S. government, homeland security is "a concerted national effort to prevent terrorist attacks within the United States, reduce America's vulnerability to terrorism, and minimize the damage and recover from attacks that do occur" (July 2002 National Strategy for Homeland Security, issued by President George W. Bush).

In more simple terms, the primary end of homeland security is to secure the nation's borders. This is not to say, however, that the concept of homeland security is well defined or clear at all times. Much debate has occurred, particularly around the establishment of the Department of Homeland Security within the U.S. government, over the exact definition of homeland security and what types of both domestic and international issues are contained within such a concept. Further, the ultimate goal of homeland security is not always clear and may change over time, including at any one point in time prevention of terrorist attacks and/or minimization of harm that may occur as a result of such attacks. Both concepts seem to fall within the overall goal of "homeland security," but each has different organizational and resource requirements, and each impacts multiple governmental agencies and offices in a different manner.

Although the concept of homeland security has taken on a new sense of immediacy and familiarity, the idea of providing for homeland security or national security has a historical foundation within the UNITED STATES dating as far back (as an identifiable concept) as the Federalist papers. As noted by Harold Relyea, both John Jay and Alexander Hamilton wrote about "na-

tional security" in the Federalist papers, Hamilton suggesting that during war, "the energy of the Executive is the bulwark of the national security." As Relyea observes, however, the concept of national security truly took shape during the period between World War I and World War II, when the idea of a need for a unified, national interest in securing the nation and a national approach to foreign policy was blossoming.

The concept of homeland security has become most well known within the context of the post-September 11 landscape of the American government. Following the terrorist events, on October 8, 2001, through an executive order, Bush established the Office of Homeland Security to carry out this national strategy, appointing former Pennsylvania Governor Tom Ridge as assistant to the president for Homeland Security. In the immediate aftermath of September 11, the concept of homeland security was a symbolic, idealistic belief in the need to provide security for the nation. Over time, however, the concept took shape in the form of concrete policy decisions issued by Congress and the president himself. Ultimately, in June 2002, Bush sought to make homeland security a permanent, established part of the federal government, proposing the creation of both a Department of Homeland Security and an executive office of the president devoted to certain aspects of homeland security, namely the National Office for Combating Terrorism, the most extensive reorganization of the federal government since the Harry Truman administration of the 1940s.

In July 2002, Bush released a National Strategy for Homeland Security outlining his vision for securing homeland security and the role that the new department was to play. This strategy outlines the definition for homeland security provided above and identifies four foundations intended to help maintain homeland security: law, science and technology, information sharing and systems, and international cooperation. Each area or foundation is given a role in providing homeland security in the post-September 11 arena. As these foundations indicate, providing for homeland security impacts more than simply the federal-level agencies. It is a highly decentralized mission, which impacts both the federal and the state government, from the national down to the local level. By recent estimates, nearly 70 federal agencies alone are involved in some aspect of homeland security, and one can imagine hundreds of state and local agencies and offices likewise impacted.

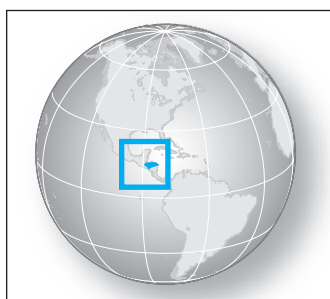
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## Honduras

**Map Page** 1136 **Area** 43,278 square mi (112,090 square km) **Population** 6,669,789 **Capital** Tegucigalpa **Highest Point** 9,416 ft (2,870 m) **Lowest Point** 0 m **GDP per capita** \$2,600 **Primary Natural Resources** timber, gold, silver, copper, lead, zinc.



Honduras is located right in the heart of Central America, sharing borders with EL SALVADOR, NICARAGUA, and GUATEMALA. Most of the people are considered mestizos, or of a mixed heritage of white and Amerindian. The country's area includes the three Caribbean islands ceded to the country by the UNITED STATES in 1971, Roatan, Utila, and Guaranja. Honduras's topography is varied, with mostly highlands through the central part of the country, flanked by coastal, tropical coasts. Currently, 7.7 percent of the country is preserved by the government, and includes tropical rainforest and fragile coastland. Education at the primary level is free and compulsory; the literacy rate for both men and women is about 30 percent. Healthcare is very poor, and conditions are some of the worst in the Western Hemisphere. The life expectancy is about 67 years old.

Like its neighbors, Honduras possesses an enormous amount of natural resources in its rainforests and coastline. One of the most precious of these resources, and also the source of notorious conflicts with Nicaragua, is the Miskito coast of the southern portion of the Honduran Caribbean coast. This preserved forest, which is home to the Miskito indigenous group, is under partial jurisdiction of the Honduran govern-

ment. Home to thousands of fish and bird species, this untouched "biogem" presents an opportunity for the country to develop sustainable tourism in its lesser developed regions.

Another natural resource of Honduras, and likewise a source of contention with its neighbors, is the Gulf of Fonseca, which is located on the western coast. El Salvador and Nicaragua also share a border with this gulf, creating a dynamic of competition and culpability for aquaculture and pollution. Shrimp farming has proliferated in the gulf, creating environmental degradation for native wild species as well as tremendous coastal development. Since three countries share the gulf, conflicts often arise when fishing harvests are diminished; addressing problems of over-fishing and water pollution to alleviate small harvests becomes a game of finger pointing.

Political life in Honduras has been tenuous and complex. Original settlements of the warlike Lencas and Jicaques were taken over by Spanish colonizing forces in 1524. Despite declaring its independence in 1838, Honduras's government has still suffered economic and political forces, such as America's United Fruit Company, that lie outside its boundaries. United Fruit Company had a long presence in the Caribbean and was notorious for its enslaving conditions of Honduran workers whose lands were monopolized and whose livelihoods were at the mercy of the huge corporation. The company has since left the country and been broken up, but present-day fruit distributors, like Dole and Del Monte, provide hauntingly familiar dynamics between their mass production and local communities.

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## Hong Kong

HONG KONG IS A FORMER British colony that returned to the People's Republic of CHINA on June 30, 1997, and is now officially the Hong Kong Special Administrative Region. Hong Kong consists of the island of Hong Kong and about 200 islands and the New Ter-

ritories that are on Kowloon Peninsula on the mainland. Hong Kong has a tropical monsoon climate. Its winters are cool and humid. Rain falls from spring through the summer, and autumn is warm and sunny.

Hong Kong covers an area of 421 square mi (1,092 square km) and has a population of 7,394,170 (2003). Its highest point is Tai Mo Shan at 3,142 ft (958 m) and its lowest point is the South China Sea at 0 m. The gross domestic product per capita is \$26,000 (2002).

Since the end of British rule, Hong Kong has functioned under the “one country, two systems” relationship with China. According to the Joint Declaration in 1984 reached by Britain and China, Hong Kong, as a special administrative region of China, would have autonomy in its internal affairs and its economic system for 50 years after the end of colonial rule. Hong Kong is a limited democracy that is governed according to the Basic Law approved in 1990 by the National People’s Congress. The chief executive is the head of government who is advised by an executive council. Laws are made by the Legislative Council, which is a unicameral body of 30 seats indirectly elected, 24 directly elected seats, and 6 chosen by an 800-member election committee.

Hong Kong began as a small fishing community and a den for smugglers that was of little significance in its early history. Hong Kong was part of a trading network that centered around Canton in the 18th and early 19th centuries. Great Britain became interested in Hong Kong as a commercial base and as a colony for its deepwater harbor. In 1841, the island of Hong Kong was occupied by British forces during the Opium War. By the Treaty of Nanjing in 1842, China ceded the island of Hong Kong to Britain “in perpetuity.” In 1860, after the Second Opium War, Britain obtained a 99-year lease on the Kowloon Peninsula, which became the New Territories. Throughout the 19th century, the development of Hong Kong from a barren island to a major Asian port was made possible by cooperation between British administrators and a Chinese business elite.

In 1912, Hong Kong experienced a major influx of refugees who escaped the turmoil in China following the overthrow of the Qing Dynasty, increasing the population from 600,000 in 1920 to 1.6 million in 1941. On December 7, 1941, Japan attacked Hong Kong and occupied it for more than three years, reducing the population to 600,000. With World War II behind them, the people of Hong Kong expressed a desire to participate more in the political process. After the communist takeover in China in 1949, many Hong Kong

residents were worried about their future. Hong Kong was again inundated with about 700,000 refugees who escaped from the civil war on the mainland. However, there came to be a quiet understanding between Mao Zedong and the British that China would maintain the status quo because of trade benefits Hong Kong provided and the \$5,000 in rent that British paid for the lease in the New Territories.

Between 1971 and 1982, Hong Kong underwent major reforms in housing, education, police, health care, and infrastructure through the leadership of Governor Sir Murray MacLehose. Beginning in 1982, British Prime Minister Margaret Thatcher met with Chinese Premier Deng Xiaoping to discuss Hong Kong’s future. In 1984, both countries issued the Joint Declaration specifying Hong Kong’s return to the People’s Republic of China in 1997 as a special administrative region. The suppression of student protesters at Tiananmen Square caused alarm among many residents of Hong Kong about their relationship with BEIJING. In 1990, the Basic Law, which serves as Hong Kong’s constitution was passed by the National People’s Congress.

Hong Kong’s population is generally homogeneous; 95 percent is Chinese and the remainder is mostly Indian and European. Cantonese Chinese and English serve as the official languages for the territory.

Hong Kong has one of the most developed economies in the world. From its beginnings as a free port, Hong Kong relies almost exclusively on international trade. Having little natural resources, Hong Kong must import its food and raw materials. Hong Kong has extensive investment trade and investment ties with China.

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## Horn of Africa

THE PENINSULA OF NORTHEAST Africa is called the Horn of Africa. It lies opposite of the southern Arabian Peninsula. This area is also known as the Somali





Peninsula because within it lies the countries of SOMALIA and eastern ETHIOPIA. It is the easternmost extension of the African continent separating the Gulf of Aden from the INDIAN OCEAN. It is sometimes also used as a name for the entire region of countries in northeast Africa including ERITREA, DJIBOUTI, Ethiopia, and Somalia and sometimes even including parts of SUDAN and KENYA. The Horn of Africa also alludes to the shape of this area because it sticks out like that of a rhinoceros horn from the continent of Africa.

The Horn of Africa is made up of a wedge of land that is cut north to south by two great geographical features: the NILE RIVER Valley and the Great RIFT VALLEY. Between these two features are high plateaus and rugged volcanic mountains. West of the White Nile River spans the great and vast SAHARA DESERT. The Great Rift Valley rises to just over 1 mi (1.6 km) above sea level in central Ethiopia and then drops well below sea level in the Danakil (or Dallol) Depression. Some places in the depression are over 328 ft (100 m) below sea level making it one of the lowest places on Earth not covered in water.

It is known as one of the most inhospitable places on Earth because the landscape is sand and volcanic rock. Much of the area is still active volcanically and tends to have intermittent earthquakes. It is also the hottest place on earth with temperatures that can reach up to 145 degrees F (63 degrees C) in the sun. From the coast of Eritrea, the Danakil Depression drops even further into the depths of the Red Sea.

The coastal lowlands along the Gulf of Aden and the Red Sea are mainly desert, as is most of Eritrea and northern Sudan. Southern Sudan is covered in savanna. Much of Ethiopia is covered in highlands that were once thickly forested. Over millennia, this area suffered from deforestation but there are still some small isolated areas of tropical forest. Much of this area could be used for agriculture but has yet to be truly developed. All of the countries of the Horn have petroleum, natural gas, gold, silver, copper, and iron ore but not much of this has really been developed either.

The main reason this area is important is that the Horn of Africa commands the Red Sea and the northwestern portion of the Indian Ocean. There are many good ports on both sides of the Horn. Ships traveling in the area headed for the suez canal and the Mediterranean from Asia, the Persian Gulf, and East Africa all have to navigate through the narrow waterway at BAB EL MANDEB, the entrance to the Red Sea. Thus, its importance is not only geographical but political as well. The people of the Horn subsist in vastly different styles

ranging from those that are hunter-gatherers and fishermen to nomads and farmers to industrial workers and more urban modern professions.

Most of the people of the Horn are farmers who still use draft animals to turn the land. Per capita income, literacy, and life expectancy are among the lowest in the world on the Horn. There are over 200 languages and dialects spoken over the Horn. There are even more ethnic groups that are further broken down into tribes and clans many of these who have deeply divided loyalties. There has almost always been conflict on the Horn for some reason or another, whether if be for political, ethnic, economic, or religious purposes and it does not look like that will change any time soon.

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## horst

**HORST** IS THE German word for a high-nesting area for a bird, so the term infers a high elevation. Early geomorphologists fittingly applied the German word to a fault block mountain range. The faulting and vertical displacement is due to tension stresses in the crust. Tension causes crustal rock to spread apart and break to form steeply inclined normal faults.

The fault lines are normal to the direction of spreading and parallel to each other at the surface, but their planes dip away from each other beneath the surface. A horst is left standing either by sinking of the crust on either side of a pair of normal faults or by physical lifting of a crustal block between the faults. Geomorphologists often use the German word *graben* (which means "trench" or "grave") for the low-lying block between two horsts.

Horsts have either symmetrical or asymmetrical profiles. Equal rates of vertical movement along the parallel faults produce a symmetrical profile. Horsts of this sort may have flatlike tops, but they are more likely in various stages of erosion. Horsts have asym-



metric (tilted) profiles when the vertical movement is along only one of the bounding faults. The resulting mountain has a steep escarpment on one side and a gentle back slope on the opposite side. The Sierra Nevada of CALIFORNIA are a classic example of a asymmetrical fault block mountains; their steep eastern escarpment faces NEVADA and the gentler western back slope faces California's Central Valley.

Horsts (ranges) in combination with grabbens (basins) form a basin-and-range topography; Nevada is in the middle of this terrain type, which extends into IDAHO, OREGON, California, UTAH, ARIZONA, and NEW MEXICO as well as northern MEXICO. Countless horsts interrupt the landscape of the region. For example, California's Owens Valley (a graben) separates the Sierra Nevada from the White Mountains (also a horst). Another example is the Panamint Mountains and Armagosa Mountains; they align on either side of Death Valley. Countless horsts occur in other parts of the world, wherever normal faulting has occurred. The Vosges Mountains of France, the Harz Mountains of GERMANY, the island country of TAIWAN, and several highland ranges of KENYA and ETHIOPIA in eastern Africa are horsts. The SINAI PENINSULA between water-filled grabben of the Gulfs of Suez and Aqaba is another prominent example.

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## Huang (Yellow) River

THE YELLOW RIVER, called the Huáng Hé by the Chinese, is the second longest river in CHINA reaching 5,500 km (3,000 mi), second only to the CHANGJIANG (Yangzi River). The regions to the north and south of the Huang River are called, respectively, the Hebei (north) and Henan (south). The chief tributaries of the Huang River are the Wei and Fen Rivers. The Huang River originates in the Yekuzonglie basin at an elevation of 4,500 m (13,500 ft) in the Bayan Kera Mountains and flows in an easterly direction through nine

regions: Qinghai, Sichuan, Gansu, Ningxia, Inner Mongolia, Shanxi, Shaanxi, Henan, and Shandong, where it finally reaches the Bohai Sea. The Huang River has made at least five major direction changes from 602 B.C.E. to today. It is believed that the most devastating direction change occurred in 1194, killing hundreds of thousands of Chinese and destroying the economy. The latest direction change occurred from 1855 to 1897, resulting in the current easterly flow.

The Huang River gets its name from its color caused by the sediment carried by the flow. Large-scale erosion occurring in the northern regions continues to be a problem for the Chinese government, as it increases the danger level of the river through buildup of sediment farther downstream. In fact, the Huang River remains the most dangerous river in China.

The Huang River basin is where Chinese civilization originates. Some historians believe this is because of a unique land structure found only here and nowhere else in the world. The land structure is called Tai Yuan, meaning a table land on a plateau. What is left on the Tai Yuan gives researchers an idea of the landscape prior to it being carved up by the river. Researchers explain that these land structures were ideal for agricultural development, community activities, and unrestricted movement because it is believed that the current Tai Yuans were once much closer together, if not a single unit.

A large problem associated with the Huang River is the continuous flooding, due in large part to the heavy sediment that is carried off by erosion and left to rest in the lower regions, causing the flow to slow and preventing the river from reaching the Bohai Sea. The river, on an annual basis, fails to reach the sea one-third of the time, which is largely attributed to an increase in ciphering off of water by families, factories, and farmers and, of course, the large amount of sediment left behind in the lower regions from erosion in the upper regions. In 1955, the Upper and Middle Huang River Administration Bureau was created under the Huang River Conservancy Commission to initiate soil conservancy and sediment reduction.

Silt deposition has created large problems for certain areas of the Huang River. In some areas the river bed is elevated 60 to 70 ft (18 to 21 m) above the surrounding towns. Since the 2nd century B.C.E., the Huang River has broken the levees some 1,500 times, inundating the surrounding towns. For example, in 1642 the levees broke, killing some 300,000 people. And again in 1938, the Chinese government decided to flood the levees in an attempt to stop the Japanese in-

vaders, resulting in the deaths of 900,000 Japanese and Chinese combined.

Currently, the Chinese government has undertaken a project that rivals no other water project in the world: to transport water from the overflowing Changjiang in the south to the Huang River in the north. Three canals will deliver the water to the drier regions at a distance of 750 mi (1,250 km). A conservative cost estimate for this project is \$30 billion; however, that can easily reach up to \$60 billion or higher as the routes that the government wants to take are dangerous and, in some cases, require almost impossible engineering feats.

Work has begun on two of the south-north canals and engineers from the east are working on an ancient waterway called the GRAND CANAL. These two canals are expected to serve a population of 20 million, a population that must ration water until the project is built. The most expensive canal is the third, which is planned to deliver water from the higher regions of the Changjiang to the higher regions of the Huang through rugged mountains. This water will provide farmers of the most important agricultural regions the resources to adequately produce corn, sorghum, winter wheat, vegetables, and cotton.

Finally, it must also be noted that the canal project put forward by the Chinese government is highly controversial because of the nature of the project, the amount of money needed to finance it, and the impact it will have on the surrounding environment.

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## Hudson River

"THE RIVER THAT Flows Both Ways" is located between Lake Tear of the Clouds and the southern tip of Manhattan in NEW YORK. It flows 315 mi (507 km) and empties into the ATLANTIC OCEAN. Its low and high

tides, along with its salty water, account for the river's bidirectional water flow.

The Lower Hudson River (an estuary) is the dwelling place of a wide variety of plants and animals. Tidal marshes (called Meadowlands) filter the water that passes through them, and over 200 species of fish inhabit the river. The Hudson is located on the Atlantic Flyway and provides food to birds migrating in this north-south corridor. Its base of limestone rock enhances the river's ability to manage common pollution.

In 1609, the Englishman Henry Hudson, captaining a Dutch ship, stumbled upon the river in his search for the legendary Northwest Passage. At the time, native tribes already occupied the 4 million acres of the Hudson Valley, which expands from its narrow watercourse from below Waterford until the approaches to the Palisades Cliffs in NEW JERSEY, across the river from New York City. The indigenous population called the valley's river, Mukheakantuk, which means "Great Water in Constant Motion," or "The River That Flows Two Ways." The Dutch first named it "River of the Prince Mauritius"; it was not until 1664 that the English named it after Henry Hudson.

During the American Revolutionary War, the Hudson River facilitated the transportation of troops and supplies from the port of New York to military campaigns taking place to the north. The completion of the Erie Canal in 1825 enabled water transportation to cross upstate New York, all the way to Lake ERIE, and from there, farther into the Great Lakes region. The canal system made the Hudson River viable for significant trade along the Atlantic and deep into the American heartland.

The Hudson's visual landscape found wide application by artists seeking a characteristic backdrop for their paintings depicting the lush New World. The first major artist known for his sketches inspired by the Hudson River Valley was Thomas Cole. His sketches became an inspiration to other artists, and the Hudson River School of Painting was formed. Today, these works of art are located in the Historical Society of Newburgh Bay and the Highlands in Newburgh, New York.

After the Revolutionary War, ferries became popular for transporting citizens across the river. But river cruises and ferry transportation in general declined with the increase in pollution, which rose to dangerous levels in the mid-20th century. Once the source of drinking water to many cities, the Hudson River experienced a time when companies and residents dumped anything from caustic chemicals to motor oil to dis-



carded food into it, bringing about levels of toxic pollution that rose to a level lethal to humans who swam in it. Over the years, actions from residents and the government have been successful in the cleanup and restoration of the river. One of the most recent actions was an Act of Congress in 1996, which designated the Hudson River Valley National Heritage Area.

Despite the river's ghastly polluted past, the Hudson River is now in better condition than many Atlantic Coast estuaries. Its cruises have become popular again. The George Washington and Tappan Zee bridges span the river and provide a view of the Palisades cliffs for its travelers. The Metro-North Hudson River line railroad serves as a commuter line and as a means of transportation for residents and visitors to visit shops in many valley cities, including New York itself. As a geographic route to New York City, the hijacker piloting one of the planes that struck Manhattan on September 11, 2001, used the river to navigate the plane south from the Boston area.

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## human-environment relationships

THE ENVIRONMENTAL approach in geography, history, anthropology, psychology, and other spheres of humanitarian thought remains one of the most alluring and unequivocal since its origin in ancient times. At the beginning of the 21st century, interdisciplinary studies of cultural history using contemporary methods of instrumental analysis are often bringing scientists to the necessity of taking environmental issues into account when conceptualizing local peculiarities of cultural evolution. As a result, an impressive variety of theories and concepts has been elaborated in the framework of scientific and humanitarian thought during the second half of the 20th century.

Trying to navigate in this boundless theoretical space, an inquisitive researcher inevitably faces the ne-

cessity to create some kind of exploratory structure encompassing these approaches and notions. Here, comprehension of human agency in natural environment evolution has been chosen as the main criterion of examination of human-nature interaction. On this base, three main directions of environmental thought development can be distinguished in contemporary humanitarian and scientific thought.

One of them, known as geographical determinism, concentrates on the environmental impact on human history. The second, concerning human agency in nature development, became popular alongside global reconsideration of the human role in the universe, which took place at the time of the scientific revolution. Adepts of a third direction tend to interpret human-environment interaction as an integrated system, all elements of which are of equal importance and are engaged in complicated reciprocal influence.

### GEOGRAPHICAL DETERMINISM

Geographical determinism comes from the "man as sufferer" paradigm in the adaptation concept. Interpretation of a human being as a passive sufferer originated in ancient natural philosophy. Since its very beginnings, the human being was regarded as a creature deeply dependent on its natural habitat.

As early as at the middle of 4th century B.C.E., geographic determinism had been designed as a specific direction of philosophic thought with at least two extreme schools: one of climatic psychology and another of climatic ethnology. Later climatic astrology also originated.

The Enlightenment ideology reconsidered these ideas about total human dependence on nature and elaborated the wide circle of geographically and climatically deterministic theories (C. Montesquieu, L. Mechnikov, E. Semple, E. Huntington, E. Reclus).

At the second half of the 20th century, this idea was treated in the framework of the adaptation concept, which is interpreted by representatives of "new" (L. Binford) and behavioral (B. Schiffer) archaeology, environmental psychology (A. Bell), and phenomenological (T. Ingold) and actional (E. Markaryan) approaches to culture studies as phenomena inherent for an active and creative human being.

In Soviet science, most attention was paid to the biological aspects of adaptation, with an emphasis on the human capacity to fit the requirements of natural environment.

At the end of 20th century, adaptive reaction has become the subject of special attention. As a result,

general theory of stresses and ecological stress concept were elaborated (P. Bell). To identify the possible character of human beings and human society in response to natural environmental changes, the concept of social and ecological resilience was introduced (A. Neil).

Thus, the idea of humans as nature modifiers and creators came to be. Roots of the idea of human domination over nature are traced as early as the Enlightenment times, when the human ability to solve rationally all his or her vital tasks was declared for the first time (T. Hobbes, C. Linney).

### ECOLOGICAL CRISIS

Along with the beginning of industrial development and the origin of first ecological crisis at the middle of 19th century, scientists study the results of a transforming impact from human activity on the natural environment (J. Marsh, A. Voeikov). During the 20th century, the idea of humans as nature-creators was conceptualized in the context theories of cultural (O. Schluter, C. Sauer) and anthropogenic (in Soviet science) landscape, and the notion of landscape as series of sequent occupancies (D. Whittlesey).

In frameworks of postmodern methodology, this idea is conceptualized in the idea of landscape as artifact, based on two ideas (T. Darvill, P. Criado Boado). One of them is that landscape should be interpreted as a mental image, which could not exist without human beings who elaborate it. At the same time, humans consciously and purposefully form their geographical environment, and their decisions about living space ordering are deeply motivated by their vital needs. Consequent application of these postulates inevitably results in partial or total negation of the natural landscape existence.

This idea has become the starting point for the theory of human ecodynamics, which concerns the analysis of changes made by humans in the landscape in a long-lasting perspective.

In spite of principal differences in theoretical backgrounds of the “human as nature-creator” concept, they incorrectly tend to date the beginning of the human impact on nature with the origin of agriculture and farming. Thus, the possibility of hunters and gatherers substantially reshaping their landscape is practically excluded or regarded as a minimal and non-permanent one, displayed only in connection with so-called secondary landscape components.

There is also the idea of mutual creativity in human-environment interaction. The process of formation of so-called integral direction of man-environment

interpretation is long and ambiguous. These ideas, originating for the first time in ancient natural philosophy, obtained theoretical scientific background during the second half of the 19th century (J. Raskin, K. Ritter).

The fundamental theoretical background for this idea was elaborated during the late 19th and early 20th centuries in the framework of anthropogeography (F. Ratzel) and biosphere theory (V. Vernadsky). The traditional variant of anthropogeography envisages attention to all spheres of human culture and to humanity itself, taken as social and biological creature (F. Ratzel, A. Hettner, A. Grigorev, A. Borzov). At the same time, some researchers proposed to limit their subject field by the phenomena, which directly and materially display themselves in the landscape (O. Schluter, O. Brun) or by the human being as an organic form of life (W. Davis).

### AN EMPIRIC BACKGROUND

Intensive deepening of our knowledge about climate, relief, flora, and fauna and their chronological and spatial distribution, which took place at the middle of the 20th century thanks to active development of environmental archaeology, geoarchaeology, and paleogeography, has created an empiric background for theoretical conceptualization of the “man in nature” idea in Western European and American archaeology, prehistory, and paleogeography. In Soviet science, such ideas were reflected in research activity of proponents of the so-called paleoenvironmental approach to prehistoric studies (S. Bibikov).

As a result, at the beginning of the 21st century, one can trace the gradual growth of popularity of the idea of mutual and interdependent evolution of nature and society. A specific form of its interpretation is proposed by representatives of mainly postmodern directions of contemporary geography, scholars who have introduced a wide spectrum of variants of landscape understanding.

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## human geography

HUMAN GEOGRAPHY FOCUSES on interpreting and describing the various ways in which humans in all places and cultures adapt to and possibly modify their natural geographic environments. At the local or national scale, human geographers look at how economic, political, and cultural issues are related to spatial organization in different parts of the planet. How have humans modified topography, changed microclimates developed and changed rivers, lakes, and even coastlines?

Human geography is distinguished from PHYSICAL GEOGRAPHY by its focus on human activities regardless of specific cultures. Changes related to different cultures or social systems is the realm of CULTURAL GEOGRAPHY.

### REGIONAL AND GLOBAL PATTERNS

Today, human geography also looks at regional and global patterns. Because of the spread of modern technology, humans today can make changes in the natural environment at a much faster rate and much grander scale than at any other time in human history. In addition, conflicts such as war can cause immediate and widespread environmental damage, such as the oil fires and spills during the various conflicts in IRAQ and KUWAIT or the widespread killing of wildlife in various African conflicts. The extent of environmental degradation and pollution in the former Soviet Union and the demise of the ARAL SEA are other examples of human-created changes in geography. Like physical geography, human geography is divided into a wide range of subtopics. These include economics, transportation, cultural geography, urban geography, and political geography. For example, human geography, when dealing with environmental issues, is not limited to natural dynamics but also takes into account the fact that there are distinct social, economic, and political environments.

The problems dealt with by human geography have varied over the course of time. In addition, new models and technical abilities affect how problems in the human-physical environment are approached. Given the diversity of philosophies and models for the description and analysis of human-environment interaction, it would be more appropriate to speak of a plurality of human geographies rather than one single human geography.

In 1992, David N. Livingstone noted different approaches to the discipline. According to this English geographer, the whole set of problems, subjects, and concepts that have developed over time have come to form part of this tradition and to be called human geography. From the time of the explorers to the drawing of maps, from the days of proposals for the study of industrial locations to the study of the distribution of wealth throughout the world, or the spaces constructed by "gay" communities or "okupas," up to the time of the survey of the surface of the Earth with remote sensors and cartography based on GEOGRAPHICAL INFORMATION SYSTEMS (GIS)—all of this has come to be a part of the human geography tradition and to distinguish it from the type of history and cultural or social and political analyses and description developed by other disciplines.

It is possible to distinguish four significant events that help to understand how different problems and subjects have become defined as human geography. These events were: 1) the formal recognition of modern geography (1870–1920); 2) the development of pragmatic perspectives (1950s); 3) the manifestation of radical and critical views (1970s); and 4) the development of what has been termed a postmodern approach along with more traditional cultural geographies (1980s and 1990s).

### FORMAL RECOGNITION (1870–1920)

Human geographies developed in most European countries were influenced by the German, French, or British schools of geography and sometimes by all three together. Some maintain that it was in these three countries that the discipline was first institutionalized as something distinct from history and geology. Between the mid-19th century and the beginning of the 20th century, and in the context of the construction and redefinition of national states and the process of imperialism and colonial expansion, geographical knowledge was clearly related to the extension of political and economic power. As it was considered, geography offered the kind of knowledge that made it

possible to acculturate and integrate or control local populations.

During this period, human geography became a distinct program in the curriculum. For example, the first chair in human geography was set up in 1870 within the context of the unification of Germany, and under the responsibility of the geographer-philosopher, Friedrich Ratzel (1844–1904). France recognized the importance of teaching geography after the loss of the territories of Alsace-Lorraine to the Germans. This was France's context for the creation of the chair of human geography under Paul Vidal de la Blache (1854–1904).

Ratzel developed a project for anthropogeography based on the analysis of the influence of natural conditions on humanity. For Ratzel, the greater the attachment to the earth (as Ratzel called the territory) the greater would be the need for a society to maintain its physical possession. Ratzel believed that it was for this reason that the state was created. The analysis of the relations between state and space was one of the main topics in anthropogeography. The development of any society would imply, as he saw it, the need to increase the size of territory and hence to conquer new areas. One can readily see the seeds of Adolf Hitler's *Lebensraum* (expanding "living space") in this approach to the state.

On the other hand, the Frenchman de la Blache was critical of anthropogeography as an approach to human geography. Rather than being interested in the influence of natural conditions on societies, de la Blache sought to analyze how societies could challenge nature and come to develop an environment suited to their needs. Within this framework he formulated his concept of the *genre de vie* (lifestyle), understood as a historically constructed relationship built up by different human groups with their surroundings, based on the use of available technologies. This was a view that emphasized human abilities and influences in modifying the physical earth itself.

For this geographer, natural human regions and regional study was seen as an expression of lifestyle, which was the whole object of study of human geography. Seen in the light of this approach, for de la Blache, the map of France was the result of the harmonizing of its different regions. In the light of the theories and studies of de la Blache, the concept of a region (the study of the particular relation of a set of diverse elements in a given area) became one of the key concepts in human geography.

In Great Britain, the Royal Geographical Society was responsible for the institutional and financial or-

ganization of the two chairs in geography, one at Oxford University and the other at Cambridge University. The first was assumed by Halford J. MACKINDER (1861–1947). The second fell to Francis Guillermand (1852–1933). Mackinder considered that geography could be useful to statesmen since it is an integrating discipline, in which studies can be made of the causal relationships between man and the environment. These studies can be conducted in specific areas and have as their purpose the analysis of these relationships on a global scale.

Toward the end of the 19th century, biology was considered to be the most modern discipline. In the light of such thinking, the concept of geography as a natural science was the guarantee required for it to achieve qualification as a science. Thus, no one hesitated to qualify geography as a natural science, thus placing evolution at the heart of any geographic explanation.

For French geographers, human geography was a discipline that leads to knowledge of the relationship of societies with their environment. For Russian geographers, the purpose of geography in education was to reveal the battle of human beings with nature, thereby leading to a better understanding of the relationship between the two. Some Russians stressed that the study of human diversity implies showing what constitutes families of different peoples, bringing them together regardless of any racial differences, beliefs, or lifestyles. On the other hand, other geographers placed work as the mediator between the physical environment and society.

North American cultural geography presented by Carl SAUER (1889–1975) is one of the few proposals of that time that attempts to rise above a global and North American evolutionary framework (particularly as it was developed in the UNITED STATES by H. Barrows, T.G. Taylor, R.D. Salisbury along with W. DAVIS and E. Semple.). In fact, Sauer makes the whole concept of culture, linked to the anthropology, the key to the transformation of the natural landscape or the visible forms of nature into a cultural landscape.

### PRAGMATIC PERSPECTIVES

In the years after World War II and to the beginning of the Cold War, regional analyses of human geographies had become the principal activity conducted in the field.

As financial capital was directed to the reconstruction of postwar Europe, a group of planning organizations were attempting to define the best locations for



productive activities. They did this using a set of geographical engineering models that would define social problems before they became major challenges. The joining of the human geographies of political and economic perspectives led to the birth of a focus on pragmatic versus theoretical or descriptive studies. For most of the geographers following this line, mathematical language and models were considered to be the most appropriate methods for true science.

Human geographies that emphasized descriptive accounts were exchanged for a more statistical approach. Neoclassical models were formulated in the belief that subjects would behave rationally and with a view to seeking a maximization of earnings and opportunities. Now human geography became viewed as a discipline entrusted with spatial analysis. From this time on, spatial organization became the principal object of study of human geographers. The scientific base was to begin with an assumption that geographic space was to begin *de novo*—that is, without people or prior history. In short, the approach was, “All things being equal, then...” Within these assumptions, the planner could move freely within geographic space, the only variables would be questions of distance, direction, and connection (linkage). The geographic region was understood as the space in which internal differences are minimized and everything beyond its boundaries would be of much greater difference or variance.

Under the idea of pragmatic geography (as another subset of human geography) there were various trends. First, quantitative geographers studied the relations and interrelations of different geographic phenomena, local variations of physical landscape, and the impact of nature on societies and of the latter on the environment. These were all to be numerically expressed and understood. The second trend involved geographers who used systems theory. Hence it is given the name “systematic” or “modeling geography.” For example, the geographer Brian Berry defines models as key to the formulation of explanations. A third school of pragmatic geography is represented by a focus on the geography of perception. Drawing on the instruments of behavioral psychology, the followers of this trend try to analyze the subject valuation of space, both in the case of the behavior of the urban dweller and that of native African communities. It is focused on culture as the key to the creation of human geographies.

A part of the legacy of the approach of pragmatic geography has been the evolution of GEOGRAPHIC INFORMATION SYSTEMS (GIS), a field in which the concept of abstract space and the formulations of a mathemat-

ical character continue to play an important role. And it is a practice now widely used by many fields of science, both physical and social.

### RADICAL, CRITICAL HUMAN GEOGRAPHIES

As part of the sociology of its era, the decades of the 1960s and 1970s witnessed a major political convulsion in the field of human geography. In addition to the controversies surrounding the Vietnam War, it was a period during which many of the long-established European colonies in Africa achieved independence. Various social movements, such as those in defense of human rights, the rights of women, and the protests of an ecological character all appeared on the world scene and were especially intense in Europe and the United States. Many contemporary human geographers not only participated in these movements but also began to question their own practices. The crisis to be identified in geography was a symptom of other crises occurring in capitalism, politics, and science.

Some human geographers now considered that scientific knowledge should not only serve for the understanding of society, but should also help to guide and transform it. Positioning themselves simultaneously against both classical and quantitative geography, they tried to establish the basis of a new science that, as they saw it, would help create the basis of a new society. These geographers called themselves radicals in the UNITED STATES; in other contexts, such as the French, the Italian, the Spanish or the Latin American world, they were referred to as critical geographers.

Both the radical and critical schools of human geography followed the philosophical tenets of Marxism and stressed first and foremost the importance of economics (not the natural environment) when it comes to the interpretation of social dynamics. Second, they stressed the role of ideology in the production of knowledge, opposing the idea that there is any possibility of creating an objective or value-neutral science. Both the radical and the critical geographers reverted to the concept of space already worked upon by the pragmatic geographers in order to provide the social content it had consciously omitted (to be scientifically neutral) when formulated in the 1950s. Radical and critical geography was a shift to emphasizing human economics and philosophies in the creation of human geographies.

The approach known as active geography was opposed to the applied geography promoted over the decade of the 1950s. The first manifestation of this approach was found in *Géographie Active* (1964) the

name of a book written by Pierre George, Yves Lacoste, Bernard Kayser, and R. Guglielmo. This book undertook an analysis designed to reveal the contradictions of capitalism in different regional geography frameworks. Thus, a type of geography was formulated for regional analysis that would reveal inherent social contradictions such as poverty, malnutrition, and precarious housing. The proposal for active human geography also gave a new significance to actual fieldwork in the countryside. Thus, for example, in the Anglo-Saxon context, William Bunge proposed the organization of expeditions to communities living in conditions of poverty in order to help them overcome their situation, establishing a priority for social welfare over academic work.

Following the interdisciplinary exchanges that were opened up by the pragmatists, the radical and critical geographers exchanged ideas with other social sciences. This further removed human geography from its earlier emphasis on the physical environment. This exchange can be seen in the influence of the book by sociologist M. Castells, *La Question Urbaine* (1972), or the philosopher Henri Lefebvre's *La production de l'espace* (1974) on the urban geography of the period.

Among the radical geographers, one of their most representative works is *Urban Justice and the City* (1973) by David Harvey. Harvey questioned the liberal theories of the city and took on a socialist posture. He adopted the Marxist theory of rent in order to analyze the valuation of urban space. He then studied the use of the land in terms of use/value categories and exchange value. This sort of analysis enabled him to understand the active importance of spatial forms in social processes, an approach that he later developed in works dealing with the role of capital in the generation of unequal space usage and the compression of space/time. In one sense, it was a human geographic view of socialism rather than the traditional emphasis on how humans modify the physical environment.

For critical geographers, particularly in Latin America, one of the most important texts has been *Por uma Geografia Nova* (1978). The author, Milton Santos (1926–2001), showed that it was possible to conceive of personal ideas that could be applied to the interpretation of the third world. In effect, his analysis of the specific nature of urban processes in underdeveloped countries and his theory of banal space (the daily space for solidarity where men, living and feeling, have the opportunity to create a new history) are an example of this. Santos offers multiple ways of perceiving social space. First, space appears as a social product,

born of human action. Second, it signifies accumulated work, the incorporation of capital into land surface, which creates lasting forms known as “roughness.” These manifestations of “roughness” turn out to be space legacies that end up by influencing the pattern of contemporary action.

In this sense, spatial patterns are the product of past processes that also condition the future. Now there were human geographers who simply followed a modified version of the philosophical view *cogito, ergo sum*—“I think, therefore I am.”

## POSTMODERNISM

This approach led the human geographer Edward Soja to argue that while modern times have granted primacy in their explanatory role to history and time, postmodernism should open up the way to the social sciences, allowing them to achieve “the spatial turn.” Such an approach would be ideal for the analysis of changes and urban dynamics in cities such as Los Angeles. Such a city has particularly diverse geographic landscapes, constantly undergoing a process of change, and continually being reshaped by local and state practice, by internationalization, and by the globalization of work and trade. The city is produced, lived in, and provides for not only a middle class society, but also women, children, old folk, gays, lesbians, a multitude of ethnic minorities, the unemployed and the poor. With the approach prevailing until now, it was difficult to identify any urban fragments associated with the place of residence of certain social classes or the establishment of certain productive activities. In fact, global cities such as NEW YORK or LONDON are composed of a discontinuous collage of partial human geographic landscapes that no longer respond to the old center-periphery pattern. Approaches such as this may also be used for geographies of rural and regional environments.

Human geographers now have conducted a series of studies governed by this perspective. Some of the work along these lines includes: a) gender studies, b) postcolonial studies, and c) new cultural geographies.

Gender studies originated in the feminist movement of the 1960s. One of the basic points of these studies was the recognition that distinct gender geographies are to be found throughout all societies and all of history and that they always play a role in the organization of patterns of human geography. For example, in the geographic patterns resulting from the locations chosen by multinational clothing manufacturers and shoemakers in different parts of the world, there is a pattern that increasingly seeks female workers willing

to work at home on a part-time basis. This means there is a new kind of manufacturing geography, one not focused solely on large plants. Gender studies have also shown the need for a new kind of urban management and planning geography, an approach that looks at the needs for mobility and recreation of women and families.

Postcolonial geographic analysis begins by studying the human organization of space both under the colonial experience and how it exists today. The book *Orientalism*, written by Edward Said (1935–2003), is considered to be the basis for this field. Said maintained that the way in which we view the East from the West is the result of a Western cultural bias or mindset. Such a vision of the East was presented as exotic, sensual, culturally inferior, and backward—all of which supported imperial European expansion between 1870 and 1914.

In this context, colonial space (geographies) became an area of contact where diverse cultures met, collided, and fought. Postcolonial studies have also tried to listen to those who were the object of the colonial experience and had often been silenced by the European discourse.

They attempt to give space to voices that come from countries that went through colonial and live their consequences today (economic dependence, dictatorship, exclusion of women). Postcolonial researchers are also now being called upon to research image construction for the Muslim world and the immigrant Muslim populations, as reflected in political discourse and in the communications media. These findings are proving useful both for the justification of the new imperialism and for the imposition of restrictive migration policies, both aspects are used for understanding the political transformation and the globalization of the world.

## CULTURAL GEOGRAPHIES

This section of human geography is the one that has turned out to be the most dynamic, although some authors believe that all human geography is really cultural geography. It was Denis Cosgrove, Chris Philo, and Peter Jackson who, in the decade of the 1980s, introduced politics into the field of culture, aiming at showing its influence on history. This was the so-called cultural turn. Completely new subjects began to be studied in detail, such as daily objects, images of nature in art and the cinema, and even the significance of landscape and how territorial identity is socially constructed.

The discussion of GLOBALIZATION is a very important issue here, especially when it is viewed as a strategy to reduce all cultures to a single model, with the threat that this implies to individual local identity. And other authors think that new subjects should be considered for future studies, such as the interaction between various factors and beliefs, while local and global factors also need to be taken into account.

One element that has always formed a part of human geography and is now the object of renewed interest is “landscape.” Cosgrove, a North American geographer, headed this movement in the 1980s. Cosgrove tried to show how economic processes such as capitalism and the relation between capital and labor influence cultural patterns. He undertook a revision of the landscape art of the 18th and 19th centuries and found a link between the different ways in which landscape was represented at that time and such things as different types of land ownership and social relations in rural areas over the centuries. He found that these paintings had an “iconographic” content, transmitting symbols that had a meaning in the places concerned because they reflected the interests of particular social classes. Today, for example, human geography landscapes are being viewed in the light of the postcolonial gender perspective.

Studies like this show how the paintings of the time formulated an exotic world of paradise, associated with tropical environments such as those of the Caribbean. This idealization hid any reference to social injustice, such as the political and economic exploitation that lay behind work on the plantations. Gender studies today clearly show that this type of painting also reflects a purely masculine point of view. They underline the differences between colonial images created by traveling women and those created by men, yet the men led the work of exploration, conquest, and control of the colonies.

Landscape paintings are also being studied with a view to showing their contribution to the concept of a “pure” national identity, a founding stone for nationality. All of this contributed to the construction of “new” geographies. James and Nancy Duncan feel that these paintings can be read as “texts.” They say it is possible to recognize the painters and that this is an expression of values, tastes, and aspirations presented in a “codified” way. As is the case with texts, different people can interpret the images in different ways. In a city, architects, dwellers, visitors or spectators each have their own view and thus the geography of landscapes is rewritten.

### MODERN GEOGRAPHERS

While the above discussion may give the impression of human geography being a fragmented field, in fact it is the only way in which we can understand the form and complexity of the organization of the modern world.

The practices of human geography today are no longer limited to simple geometric space. Rather, modern human geographers stress how geographic space is organized by and for relationships. This means that geographic space no longer is conceived of as a static container for objects, processes, or flows—Euclidian geometry (with the dimensions  $x$ ,  $y$ ,  $z$ ) or simply by the laws of physics and natural processes. There has been increasing importance of the concept of “place” (local human-physical environments) in the work and thinking of human geographers over the last two decades. The visions of place of John Agnew and Doreen Massey are complementary in this connection and allow a better understanding of the concept. For Agnew, the concept of place has three dimensions: the first is connected with the idea of location as it refers to the social and economic processes that endow it with a material character; the second—locale—refers to daily social relationships that lead to the creation of an environment (setting); and the third refers to the creation of a subjective feeling as to this environment.

The processes participating in the creation of this place involve actors operating at different levels. This English geographer points out that the relationships places maintain with each other are the product of particular power arrangements, be these of an individual, institutional, material or imaginative character; they are the specific interrelationships that define the particular characteristics of each one. Clearly, for human geographers, the role and impact of nature upon humans and how humans and their various idiosyncratic cultures and politics affect the organization and manifestation of geography remain key topics for analysis and description.

### POLITICAL GEOGRAPHIES

The field of human geography made big strides forward between 1910 and 1930. The imperial expansion of the European countries was inspired by the idea that the power of a state was based on its capacity to expand its territory, a concept used to justify German expansion in Europe between 1933 and 1945. After the fall of Hitler, the whole field of political geography suffered from a corresponding loss of prestige that lasted until 1980, when it began to arouse interest once again.

Two factors have played a big role in its rebirth; first the fall of the Berlin Wall in 1989, considered a symptom of the decline of the Soviet bloc, the end of the Cold War, and the birth or rebirth of states that would be incorporated into the market economy; and second, the assault on the World Trade Center towers in New York City and the Pentagon near Washington, D.C., in 2001. On the one hand, the United States appeared as the world's leading military power and adopted an aggressive Middle East foreign policy.

The interest of the United States lies in controlling territories, populations, and natural resources, particularly oil, in that part of the planet; but, on the other hand, it is faced with the organization of radical groups using tactics to destabilize institutionalized methods of warfare. (They do such things as attacking civilians who are then beset by a feeling of insecurity. It is no longer a question of confrontation between states, but now within states; there is no such thing as neutrality or the laws of cease-fire. And the financing providing for the activities of these groups is usually of criminal origin.) Both of these series of events have unleashed processes that form a part of the agenda for political geography today.

The new agenda includes the reformulation of the relationship between territories and power. In this sense, the state is no longer the only basic legal and administrative unit that creates other types of international political relations. Organizations such as the EUROPEAN UNION and other international and transnational agencies have powers that have often been redefined, so that they can now acquire authority over the territorial states themselves (one example would be the World Trade Organization). These new types of organizations have also redefined the sovereign power of individual states, now sometimes reduced to certain limited fields such as the management of labor markets. In fact, functions that before were the exclusive domain of the state, such as capital attraction promotion, are now also encouraged by political groups associated with specific regions or cities. State territorial sovereignty is increasingly questioned in some countries like COLOMBIA, where guerrilla fighters and drug traders control part of the national territory. Frontier building also depends to a great extent on the new vision of power and of territory. Processes designed to stimulate the free circulation of goods and persons exist at the same time as the increase in measures destined to prevent displacement.

Thus, while the European Union extended its eastern frontier in 2004 to include SLOVAKIA, SLOVENIA,



MALTA, POLAND, LATVIA, LITHUANIA, CYPRUS, and the CZECH REPUBLIC, the Mediterranean area is becoming a major monitoring system designed to restrict the access of people from Africa to the New Europe. The wall raised by Israel on the Gaza Strip is also aimed at preventing the Palestinian population from entering the country. And, finally, the direct relation between state-nation-territory is now being challenged. It is true that the so-called equivalence of these terms was fractured when local national claims led to an increase in the autonomy of certain regions of the planet (Cataluña, the Basque Country, Northern Ireland, Quebec and Casamance) or to separatism (with the division of the ex-Yugoslavia and the independence of EAST TIMOR).

The agenda for political geography in the 21st century is engaged in redefining the relationship between state, nation, and territory. It is also incorporating new concerns (such as the environment or HIV/AIDS) and new subjects (guerrilla fighters, mafias, emigrants, and refugees), new conflicts (particularly of an ethnic-religious character such as between INDIA and PAKISTAN or in SUDAN), and studies of future scenarios, such as the political and economic role in this new century of countries like CHINA.

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## Humboldt, Alexander von (1769–1859)

ALEXANDER VON HUMBOLDT is significant to the study of geography because of the breadth of his

scientific inquiries and knowledge and his ability to integrate these studies within larger works that were both scientifically advanced and appealing to a wider nonspecialist public. He was known as a natural scientist of the highest order, working to unify studies of botany, zoology and ecology, but also as a competent writer, whose works provided a wide audience with their only glimpse of South America, a continent previously known to most through myth and speculation.

Born into a relatively minor noble Prussian family, he was equally a product of his class and of his times. Young men of wealth and breeding in mid-18th-century Berlin were influenced by the philosophies and scientific principles of reason inherent in the French Enlightenment, as well as the more adventurous spirit of early German Romanticism. Accordingly, Humboldt went to the leading universities of the day, especially Göttingen, to immerse himself in the natural sciences. A natural polymath, he undertook courses in botany, literature, archaeology, electricity, mineralogy, and so forth.

After a short career working for the state as a mineralogist, he did what so many of his generation and social class did and set out for his grand tour. But Humboldt did not head to ITALY or GREECE as was fashionable. Instead, he set his sights on South America, which at that time was mostly unknown and in fact restricted to non-Spaniards. But the king of SPAIN was attracted to the fact that Humboldt had his own means to support his travels and to his potential as a mineralogist, since the silver mines of Peru were not infinite.

Humboldt spent five years traveling with his companion Aimé Bonpland across VENEZUELA, COLOMBIA, ECUADOR, PERU, MEXICO, and CUBA, returning in 1804 to Paris, FRANCE, where he began to publish accounts of his travels. His descriptions captured the imaginations of both scientists and the general public, with its details of canoe trips up the Orinoco River and horseback rides across passes high in the ANDES, and also with vivid illustrations done by Humboldt himself. Scientifically, his work was useful not simply as a collection of botanic and zoological specimens, but also as a work of analysis on the forces of nature and on how the geographic environment influences plant and animal life of a certain region.

This was an innovation in a scientific community generally more interested in description and classification than in interpretation. Humboldt's writings stress again and again the importance of unity in nature and man's understanding of environmental systems in their entirety. His monographs on Mexico and Cuba set a

standard for the field of geography, being the first to incorporate natural science, politics, and economics all within one study.

By the 1820s, Humboldt was arguably the most famous natural scientist in the world. He was well known in all scientific quarters but was also personal friends with the leading Romantics, such as Johann Wolfgang von Goethe. His prose was admired not just as brilliant science, but as beautiful literature. His major work, *Rélation historique du voyage aux régions équinoxiales du nouveau continent*, was published eventually in 30 volumes, appearing intermittently between 1814 and 1834. One of these volumes was called *Personal Narrative*, and it included Humboldt's thoughts on his own place within the world he was studying. Later travels included a voyage to RUSSIA and Central Asia in 1829, with an account published in 1843. His third major work was a comprehensive survey of all creation, *Kosmos*, published posthumously in 1862.

Humboldt was part of a long tradition of polymath scholars or Renaissance men, whose specializations reached into numerous disciplines and subfields, bringing comparative knowledge to its greatest advantage in whatever arena he explored. And like many of those before him, Humboldt was not merely content to be a scientist. He remained loyal to the calling of his noble origins, serving many years at the court of the Prussian kings in Berlin, first as chamberlain to Friedrich Wilhelm III, then as councilor of state to Friedrich Wilhelm IV. His works served as inspirations for the next generation of scientists, most notably Charles Darwin, who knew parts of *Narrative* by heart.

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## Humboldt Current

THE HUMBOLDT CURRENT, also known as the Peru Current, is an ocean current that flows along the western coast of South America, affecting the water

and air temperatures of coastal CHILE and PERU. It is one of the largest ocean currents in the world, bringing cold water north from the South PACIFIC for thousands of kilometers (from 40 degrees S to 5 degrees S) before it dissipates in the warmer waters around the equator.

The Humboldt Current, named for Alexander von Humboldt, the German naturalist and geographer who devoted much of his work to South America, is small and sluggish in comparison to the GULF STREAM and works in the opposite fashion, bringing colder water north from ANTARCTICA and lowering temperatures along the Pacific coast by 45 to 47 degrees F (7 to 8 degrees C).

Its chilled air carries less moisture, thus helping to create the world's driest desert in Chile's Atacama Desert. The northern end of the current flows past the Galápagos Islands (off the coast of ECUADOR). Cooler water and air temperatures have affected the wildlife of the Galapagos, allowing cold-water species such as penguins and fur seals to thrive as far north as the equator.

The Humboldt Current creates one of the largest and most productive marine ecosystems in the world. Cold waters with low salinity and high levels of nutrients are brought to the surface through upwelling, providing sustenance to fish and marine mammals. The coasts of Peru and Chile are therefore one of the largest fisheries in the world, with approximately 18 to 20 percent of the world's fish catch. Dominant species include sardines, anchovies, and mackerel. Upwelling occurs off the shores of Peru year-round, sometimes as far as 620 mi (1,000 km) into the Pacific Ocean, but only during the summer off the coasts of Chile.

The current is periodically disrupted by climatic changes known as EL NIÑO, referred to by meteorologists and oceanographers as El Niño Southern Oscillation (ENSO) events. El Niño usually consists of winds blowing perpendicular to the current, coming from the west across the Pacific, bringing warmer waters with lower nutrients and unusually heavy rains. The causes of this are uncertain, potentially related to changes in circumpolar currents, which may in turn be caused by effects of global warming on the poles. ENSO events can seriously disrupt the local climate and the productivity of the region's fisheries.

Human activity, however, is also a cause itself in the disruption of the area's rich biodiversity. Overfishing threatens the marine mammals and sea birds that rely on fish for their basic diet. Such species include sea otters, sea lions, large sea birds, and whales. Pollution is also a problem in the region, caused by sewage and

industrial waste, particularly related to petroleum and copper exploitation.

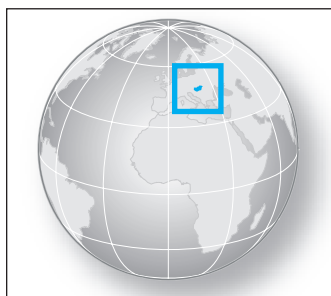
Both Peru and Chile are increasing levels of development in tourism and urbanization along their lengthy coasts, but they have also joined together in regional cooperation for managing the Humboldt Current ecosystem. International groups such as UNIDO (United Nations Industrial Development Organization) and GIWA (Global International Waters Assessment) are working to develop comprehensive sustainable aquaculture management proposals.

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## Hungary

**Map Page** 1133 **Area** 35,919 square mi (93,030 square km) **Population** 10,045,407 **Capital** Budapest **Highest Point** 3,346 ft (1,014 m) **Lowest Point** 257 ft (78 m) **GDP per capita** \$13,300 **Primary Natural Resources** bauxite, coal, natural gas.



HUNGARY IS UNIQUE among the nations of Europe in many ways: a relatively flat country among hillier neighbors, a homogenous population with a language and culture unrelated to the peoples around them, and a long history as a unified nation in the midst of a region known historically for its diversity and political fragmentation. The nomadic Magyar tribes who emigrated from the area around the Urals around the year 900 C.E. founded a state that has dominated this region of the middle Danube for over a thousand years.

Since the collapse of the Soviet Union's dominance in Eastern Europe in the 1990s, Hungary has emerged as the strongest economy once again in the region and led the pack in its reintegration with the Western world, formally joining the EUROPEAN UNION in May 2004.

Hungary is located at a strategic crossroads between Western Europe and the Balkan Peninsula, and between RUSSIA and the MEDITERRANEAN SEA. Here, the DANUBE RIVER flows through a broad plain with some of the most productive agricultural land in Europe. To the east of the river especially, the Great Hungarian Plain, or Alföld, spreads out for miles of almost completely horizontal fields and grasslands, or *puszta*. The plain is surrounded by the arc of the Carpathian Mountains, which form the borders with Hungary's neighbors to the north (SLOVAKIA, UKRAINE) and to the east (ROMANIA). To the south, the plain merges into the more hilly neighbors of the Balkan Peninsula (SERBIA AND MONTENEGRO, CROATIA, SLOVENIA), while the west rises slightly in elevation at the foothills of the ALPS on the frontier with AUSTRIA.

Through much of its history, many of these borders were in fact within the kingdom of Hungary, which once encompassed the entirety of Slovakia and Croatia, much of northern Serbia (the Vojvodina), and over a third of Romania (the historic province of Transylvania). After World War I and the Treaty of Trianon (1920), however, non-Hungarian peoples were granted self-rule, and Hungary lost three-fourths of its territory, a fact that continues to influence politics and relations with Hungary's neighbors today.

Landlocked Hungary is dominated by the river Danube (called here the Duna), with its chief tributary, the Tisza, flowing through the eastern part of the country. Other major rivers include the Dráva on the southern border, the Rába in the northwest, and the Körös, which flows in from the east. In the central western part of the country, Lake Balaton forms the largest lake in Europe, covering 233 square mi (598 square km). Balaton is well-known for its resorts and for its pike, a national dish of Hungary, served with dill and paprika.

Much of Hungary sits atop large reserves of geothermal, mineral, and curative waters, and Hungarian cities are famous for their spas, some of which have been in existence for centuries. Some of the geothermal spas are located in the mountains of the northern part of the country, where Hungary's earliest industries were centered, mining coal, iron, silver, zinc, and gold until these were mostly depleted. The mines were closed in the 1990s to the great detriment of the local economy. This part of Hungary is also known for its Eger and Tokaj wines.

Budapest, until 1873 the twin cities of Buda and Pest, is the center of the country in every way, geographically, historically, and economically. A fifth of the population lives there, and most of Hungary's in-





Hungary's Budapest is the center of the country in every way, geographically, historically, and economically.

dustry is centered in the Budapest region. Hungary's other cities are much smaller but play important roles as regional centers: Debrecen, Miskolc, Szeged, Pécs, and Győr. The eastern plains are sparsely settled, populated instead by herds of horses and cattle and covered with farms raising Hungary's chief products: wheat, corn, sunflower seed, potatoes, and sugar beets. Today, Hungary's economy is the most dynamic in the region, with more foreign investment per capita than any other country in eastern or central Europe.

Tensions remain with some of its neighbors, however, over treatment of their minorities within Hungary's borders, and privileges given to Magyars living outside current borders (especially in Slovakia and Romania). The divisive spirit of nationalism also has called for renewed discrimination against one of the largest populations of Romany in Europe, with numbers running from an official count of 142,683 in 1990, to unofficial estimates of up to 600,000.

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## Huntington, Ellsworth (1876–1947)

CONTEMPORARIES WERE impressed by the clarity of Ellsworth Huntington's style, the intensity of his reasoning, the simplicity of his grand theories, and his unique ability to generalize: "With devastating logic and sound scholarship, Ellsworth Huntington shows how climate, weather, geographical location, diet, health and heredity control the character of a nation—and determine its dominant or defensive position in history and the advance of civilization." Such is how the geographer was described on the book jacket for his *Mainsprings of Civilization* (1947).

Huntington was probably the geographer who defended the cause of environmental determinism with the highest degree of conviction. His work on how climate has influenced the evolution of human societies was informed by the fieldwork he first did in Asia and the MIDDLE EAST, and later in the American southwest. He had traveled widely over North and South America, Europe, Africa, Asia and Australia. Huntington's writings reached an audience well outside the small circle of American geographers.

Geographers did not unanimously approve Huntington's bold generalizations, and some refuted early on the conclusions of Huntington's *The Pulse of Asia*. Historians were annoyed by the way in which Huntington overworked his materials to restate his thesis on the development of high-type civilizations. His racist deductions were not exempt of contradictions. For instance, past migration through the Arctic would explain Native Americans' inability to innovate, but Eskimos would be especially ingenious because they have remained in the Arctic.

Colleagues called his work an enthusiastic toast to himself because New England was always depicted as the most advanced area on his world maps of the "dis-



tribution of general progress.” Most scholars criticized Huntington’s speculations on the influence of weather on culture and his measurement of civilization level. Conducted largely by botanists and geologists, later studies on climate change have proved, however, that his speculations on the succession of wet and dry cycles were correct.

Huntington was born in Galesburg, Illinois, went to Beloit College for his B.A. degree, then taught at Euphrates College (Harput, Turkey) from 1897 to 1901. He resumed his studies in the United States and received an M.A. from Harvard University in 1902. As a graduate student, he took part in two scientific expeditions in central Asia, which he described in *Explorations in Turkestan* (1905) and his famous *The Pulse of Asia* (1907). Yale awarded him a Ph.D. in 1909. After graduation, he worked at the Carnegie Foundation for three years. Huntington returned to Yale, where he taught geography until 1913. He became a research associate in 1917, a position that gave him the freedom needed to concentrate on his ambitious research program on climate and civilization. He occasionally taught seminars at Clark and Chicago universities but did not seek contacts with students. Ellsworth Huntington died a professor emeritus of geography at Yale.

Huntington was an unusually prolific geographer. His articles were published in academic as well as non-academic journals: the *Bulletin of the American Geographical Society*, *American Historical Review*, *Harper’s Magazine*, and the *Journal of Race Development*. He wrote no fewer than 29 books and co-authored many others, in which he either described the countries he visited or exposed his theories on climate change and eugenics. His bibliography includes major monographs such as *Palestine and Its Transformation* (1911), *The Climatic Factor as Illustrated in Arid America* (1914), *Civilization and Climate* (1915, re-edited twice), *World Power and Evolution* (1919), and *Climatic Changes* (1922).

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## Hunza

THE HUNZA VALLEY in north PAKISTAN is noted for two features: Burushaski, a language that appears to be unrelated to any other language in the world, and secondly, the myth of the health and longevity of its inhabitants, the Hunzakuts. This valley was the reputed location of novelist James Hilton’s Shangri-La.

The valley is located north of Gilgit, the major town in mountainous north Pakistan sandwiched in between the eastern end of the HINDU KUSH mountains, the western end of the HIMALAYA MOUNTAINS, and the Karakorum range to the north. In ancient times, it provided a very difficult footpath for Buddhist pilgrims journeying from the Chinese Pamirs in the 7th century down to the famous Buddhist monasteries in the Swat valley and neighboring Taxila.

The valley, 25 mi (40 km) long, has settlements on both banks of the Hunza river, one properly called Nager populated by “Twelver” (Shia) Muslims on the left bank with paths leading to the Hispar glacier to the east and Braldu in neighboring Baltistan, and the right bank occupied by the dispersed settlement around Karamabad, a name derived from Karim, the son of the 49th imam, the Aga Khan, of the “Sevener” Isma’ili branch of Islam.

In the upper reaches of the Hunza valley, in Gugal, Hunzakuts gained superiority over the Wakhi ethnic group that is indigenous to the high Pamir. The British conquered Hunza in 1891, bringing it under control of the Gilgit Agency, nominally under Kashmiri domain, but the British Resident in Gilgit had suzerainty over all Gilgit. The British supported a local despot, the Thum (later Mir), a hereditary chieftain who, with the aid of a *wazir* (prominent adviser), ruled his subjects from Baltit.

In 1936, a British nutritionist published a book on diet and nutrition and featured Hunzakuts as possessing longevity because of their diet. To date there is no credible evidence that determines that the Hunzakut diet of old, not to mention the current diet of the past four decades, contributes to longevity. Nevertheless, modern-day Western pilgrims converge on Hunza seeking the secrets of longevity through consuming the mythical Hunza diet that is vegetarian in origin.

In the 1930s Nazi era, the Swiss-German vegetarian, Dr. Ralph Bircher, conducted research about the Hunza diet. Adolf Hitler, the Nazi leader, and Heinrich Himmler, the Nazi SS commander, both vegetarians, had sponsored several plant gathering and physiological research expeditions to Hunza seeking “Aryan”

plants suitable for transplanting to Nazi-conquered lands. They promoted the consumption of a diet replicating the Hunza diet, later to be popularized as breakfast muesli.

The Hunzakut vegetarian diet was not by choice; in the steep landlocked mountain valley they lacked access to high-altitude pastures for ruminants. Almost all vegetation in the valley is anthropogenic and field crops were focused on grain because the local chieftain demanded grain as tax revenue. Prior to World War II, the Hunza diet was estimated to be 50 percent derived from apricots. It is true that apricots have substantial antioxidant qualities, but any reason for longevity has to be found elsewhere.

The stunted stature of some of the residents reveal extreme malnutrition when young and recollections of elderly resident tell of spring starvation when food stocks were depleted. Many elderly women tell of children dying during periods of minimal dietary intake. Alexander Leaf, a noted gerontologist who has studied the Hunzakuts, has suggested that many other factors contribute to longevity, such as vigorous physical activity, status granted long-lived persons, and modest caloric intake.

In the early 1950s, German scientists (including a well known Nazi) who made an early foray into Hunza after the jeep track was constructed, recall that the major food product that was conveyed to Hunza at great expense was British canned corned beef produced in Argentina. Goats are kept in Hunza, but their husbandry is traditionally governed by social taboos found throughout that region of northern Pakistan and AFGHANISTAN. The Neolithic goat cult bars women from goat husbandry; it is limited to male work because of the relation of the domestic goat to the wild ibex goat found in the high mountains.

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## Huron, Lake

LAKE HURON IS ONE of the five Great Lakes and is named for the Hurons, a Native American people who once lived along its shores. Lake Huron covers 23,000 square mi (59,570 square km) and is 206 mi (332 km) long. At its greatest width, it is 193 mi (295 km) across. It lies at an elevation of 577 ft (176 m) above sea level and is 750 ft (229 m) deep at its deepest point.

Lake Huron is connected to Lake SUPERIOR via the St. Mary's River. The Soo Canal, with four locks on the U.S. side and one on the Canadian side, allows ships to pass the rapids, at which important hydroelectric stations have also been built. Lake Huron is connected to Lake MICHIGAN by the Straits of Mackinac, which are so wide that some hydrologists argue the two lakes are actually two lobes of a single lake and are regarded as separate only because of a historic accident: The first French explorers in the area discovered the lakes' southern ends long before discovering the straits. Lake Huron flows into Lake ERIE via the St. Clair River, Lake St. Clair, and the Detroit River.

### MACKINAC ISLAND

Lake Huron contains the largest number of islands of any lake in the world. Manitoulin Island is the largest of them and delineates the North Channel and the west side of Georgian Bay. It is also the largest island in a body of fresh water. Mackinac Island, in the Straits of Mackinac, is a tourist resort well known for its picturesque scenery and complete absence of motor vehicles. During the Gilded Age, the great captains of industry regularly stayed on Mackinac Island to escape the sweltering summer air of their Chicago townhouses, and their wives enjoyed promenading on the Grand Hotel's large veranda.

Manufacturing is the source of 80 percent of the area's income but has resulted in dangerous levels of pollution. Among the notable industrial cities on the shores of Lake Huron are Flint, Midland, Bay City and Saginaw in the U.S. state of MICHIGAN, and Sarna, Ontario in CANADA. The lake itself carries considerable traffic in raw materials and finished goods, with seven deepwater U.S. ports and four Canadian ports.

The Lake Huron area is rich in mineral resources, timber, and mining. Agriculture in the area centers primarily around dairy farming, although there is some row-crop and fruit cultivation. The shores of Lake Huron remain rich with wildlife, and the lake itself boasts a wide variety of fish. However, industrial pollution has made the consumption of lake fish medically

risky, leading to the severe curtailment of commercial fishing in the area. Sports fishermen have continued to pit their skills against the lake's fish but are warned against eating substantial amounts of their catch.

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## Ibn Battuta (1304–1377?)

BORN IN TANGIER, MOROCCO, Muhammad ibn Abdullah ibn Battuta was a famous Arab traveler and writer who explored in Africa, Europe, and Asia. Ibn Battuta's journey began in North Africa in 1325 with travels that included visits to EGYPT, SYRIA, Mecca on the Arabian Peninsula, northeastern IRAN, southern IRAQ, the RED SEA, YEMEN, East Africa, Asia Minor, AFGHANISTAN, INDIA, Bengal, INDONESIA, CHINA, and SPAIN; his travels ended in 1353 after a journey across the SAHARA and Western Africa. The main motive behind the Moroccan traveler, like other Muslims of his time, was to perform the ceremony of hajj or pilgrimage of the holy places of Mecca in western Arabia or in what is now SAUDI ARABIA. He left Morocco, he tells us, "swayed by an overmastering impulse within me and a desire long-cherished in my bosom to visit these illustrious sanctuaries." For most of his travels, Ibn Battuta was either returning to Mecca or journeying away from the holy city.

During his adventures, he spent months of study in DAMASCUS, Syria, and sought employment and generous rewards in government offices in the Sultanate of Delhi in India under an Islamic kingdom of Turkic origin. As a devoted Sufi inclined in the mystical and ecstatic dimension of Islam, mostly popular in North Africa in the 14th century, Ibn Battuta stayed with

other Sufi devotees and frequented places where saintly masters resided, seeking to gain divine grace or baraka under their guidance for a personal communion with God. He also traveled for the sake of curiosity and adventure to some unknown places in the Islamic world, or dar al-Islam. Describing his final travels, Ibn Battuta's rare accounts of East African city-states and the Mali Empire in the 14th century have long been important to historians.

Ibn Battuta came from a family of jurists and judges, with his ethnic ancestors from rural Berbers of northern Morocco. As a legal scholar, he was educated in Islamic sacred law (Sharia) and well versed in classical Arabic writing and poetry. Based on his travels in Asia Minor, India and western Africa, he expanded the genre of travel writing recorded in the book *Rihla*, or *Book of Travels*, published in 1357. Although Muslim writers and travelers from northwestern Africa produced descriptions of the places they traveled to while making the pilgrimage, Ibn Battuta further developed the genre of travel writing by making it more of a detailed account of the traveled lands and encountered people rather than a mere extension of religious preoccupation.

The *Rihla* is mainly significant in its descriptions of the Turkish chiefdoms of Asia Minor, India, and East Africa. It offers the most comprehensive and detailed depiction of the Islamic world after the disintegration

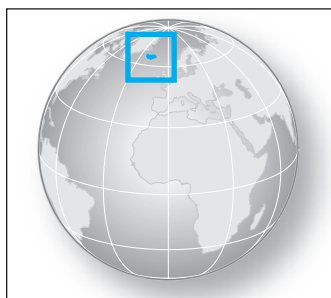
of the Muslim empire in 1258 and the Mongol dominance of the Eurasian landmass in the 14th century.

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## Iceland

**Map Page** 1130 **Area** 39,769 square mi (103,000 square km) **Population** 280,798 **Capital** Reykjavík **Highest Point** 6,950 ft (2,119 m) **Lowest Point** 0 m **GDP per capita** \$30,200 **Primary Natural Resources** hydro-power, geothermal heat.



**ICELAND IS** A volcanic island lying on the Mid-Atlantic Rift 170 mi (280 km) southeast of GREENLAND and 500 mi (800 km) northwest of Scotland. Iceland is a mountainous country with an average elevation of 1,640 ft (500 m). Coastal lowlands (from sea level to 650 ft or 200 m elevation) ring the island and constitute one-quarter of its area. Most of the nation's population lives in the coastal lowlands, especially in the capital region. Glaciers cover 11 percent of Iceland, which includes Europe's largest, Vatnajökull, at 3,240 square mi (8,400 square km). Glacial activity and marine erosion have carved coastal fjords and numerous valleys in the landscape; deep fjords are the hallmark of northwest (West Fjords) and east (East Fjords) Iceland.

Despite its northerly latitude, Iceland has a maritime climate: cool summers and mild winters, owing to the moderating influence of the warm Irminger Current. Mean annual temperature ranges from 36 to 43 degrees F (2 to 6 degrees C) in the coastal lowlands and 37 to 39 degrees F (3 to 4 degrees C) in the mountainous interior. Reykjavík—the most northerly national

capital in the world—experiences average temperatures of approximately 32 degrees F (0 degrees C) in January and 51 degrees F (10.6 degrees C) in July. Annual precipitation varies with local topography, particularly from rain shadows created by mountains and glaciers, and is typically greatest in fall and early winter. The highest annual precipitation (156 in or 400 cm) occurs in southeast Iceland on the Vatnajökull and Mýrdalsjökull glaciers; the lowest (16 in or 40 cm) occurs in the volcanic desert north of Vatnajökull's rain shadow.

Rivers are numerous in Iceland because of abundant rainfall and glacial melt. The Þjórsá (143 mi or 230 km) and Jökulsá á Fjöllum (128 mi or 206 km) are Iceland's longest rivers. Many rivers are being dammed for hydropower, which currently supplies 83 percent of Iceland's electricity. Waterfalls are common in Iceland's young volcanic landscapes, including Dettifoss (144 ft or 44 m), Europe's most powerful waterfall. Lakes are also numerous; some of the largest, Þingvallavatn (32 square mi or 84 square km) and Þóisvatn (27 square mi or 70 square km), are of tectonic origin, while others are created by lava or ice dams or volcanic explosions. Volcanic activity has created an abundance of geothermal areas marked by hot springs, mudpots, and geysers. Nonpolluting geothermal energy supplies 89 percent of Iceland's heating needs.

Iceland's isolated locale has greatly influenced its biological diversity; flora is largely northern European in origin and includes 485 species of vascular plants, 560 species of bryophytes, and 550 species of lichens. Seventy-two species of birds are known to nest in Iceland; waterfowl and seabirds are prominent. The arctic fox (*Alopex lagopus*) is Iceland's only native land mammal.

A striking aspect of the Icelandic landscape is the lack of tall trees. Prior to Norse settlement in 874 C.E., dwarf birch woodland covered about 25 percent of Iceland, chiefly in the lowlands. Cutting of trees for fuel and housing and heavy grazing by sheep diminished the woodland area and limited regeneration. Today birch woodland covers only 1 percent of Iceland. Sixty-three percent of Iceland is poorly or nonvegetated and erosion of exposed volcanic soils is a national problem.

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## Idaho

IDAHO'S VAST areas of unspoiled beauty and natural wilderness give every reason for the 1,293,953 residents (2000) to know their home as the "Gem" state. Idaho is bounded by CANADA in the north, MONTANA and WYOMING in the east, UTAH and NEVADA in the south, and WASHINGTON and OREGON in the west. The capital and largest city is Boise, but Pocatello and Idaho Falls are also important commercial/agricultural centers.

Much of the state's 83,557 square mi (216,413 square km) can be divided among three land forms (ROCKY MOUNTAINS, Columbia Plateau, and Basin and Range) sharing some of the most rugged, unspoiled beauty anywhere in the United States.

In the Rocky Mountain region, the Bitterroot Range dominates the Panhandle region of the north and along the Montana border, where just 45 mi (72 km) separates Idaho from its two neighboring states of Washington and Montana. The mountains then run south and a little east along the border with Wyoming. The names of some other important mountain ranges (Sawtooth, Lost River, Bighorn Crags, Coeur d'Alene, and Seven Devils) bring forth strong images of the natural beauty and ruggedness that sets this landscape apart from that of other states. The state is also home to the deepest gorge in North America. From the summit of the Seven Devils the Hells Canyon gorge drops nearly 7,900 ft (2408 m) to the waters of the Snake River below; deeper than the GRAND CANYON.

The Columbia Plateau region extends east out of Washington into Idaho at the base of the Idaho Panhandle then follows the path taken by the Snake River across southern Idaho. The Snake River Plain is itself a unique geography, built up from ancient lava flows that cover strips of land 20 to 40 mi (32 to 64 km) wide on each side of the Snake River. Shoshone Falls on the Snake River, drops 212 feet (64 m), making it

higher than Niagara Falls. Between the Rockies and the Columbia Plateau lies the Basin and Range region, with numerous grassy plateaus, rolling hills, deep valleys, and mountains as you move toward the east.

The state's waters are divided among major rivers including the Coeur d'Alene, Snake, St. Joe, St. Maries, and Kootenai, and Pend Oreille Lake, American Falls Reservoir, Bear Lake, and Coeur d'Alene Lake.

Idaho's climate is diverse but strongly influenced by Pacific weather patterns that serve to moderate weather extremes. Generally, the northern part of the state is cooler than the southern parts with greater precipitation. Typically, summers are hot and dry, particularly in the south, with cold, snowy winters in the north.

Early economic activity in the region was tied closely to the early explorers and fur traders that moved eastward out of the Columbia River region of the Oregon country into what is today Idaho. By the 1840s, however, fur supplies from the region had been severely depleted and it wasn't until the discovery of gold in 1860 that economic activity picked up again. The typical rush of settlers followed, all hoping to strike it rich either from finding gold themselves or from taking it from the miners in one of the many towns that seemed to spring up overnight.

A second rush occurred in 1882 when gold was discovered at Coeur d'Alene. But the boom was short-lived because the results of the strike were disappointing. Fortunately, a major discovery of silver at the same time was able to sustain the mining boom. The late 19th and early 20th centuries witnessed a rise in cattle and sheep ranching as agriculture moved to the front of the state's economic activity. Recently, manufacturing has replaced agriculture as the most important industrial sector. Cattle and dairy goods are among the leading agricultural products in addition to potatoes (for which the state is famous), hay, wheat, peas, beans, and sugar beets. The state's unspoiled natural beauty has also led to a strong year-round tourist industry, with Sun Valley serving as one of the state's leading resorts.

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## Illinois

ILLINOIS IS A midwestern state located in the north-central part of the UNITED STATES. Lake MICHIGAN and INDIANA border the state in the east, while WISCONSIN borders the state in the north. KENTUCKY lies to the southeast, across the Ohio River, while the MISSISSIPPI RIVER separates the state from MISSOURI and IOWA in the west. The state's 57,918 square mi (150,007 square km) ranks Illinois 25th in size in the United States. However, with 12,419,293 residents, the state ranks fifth in terms of total population and 11th overall in population density. Interestingly, the top-ten largest cities in the state (led by Chicago at 2,806,016) account for about 32 percent of the total population. In terms of per capita income, Illinois ranks 10th at \$32,875. The state capital is in Springfield in the west-central part of the state.

The state's lands were fashioned by late Cenozoic glaciation when rugged hills in the north were leveled

and the valleys filled in. Elevations across the state range from 279 ft (85 m) above sea level near the Mississippi River to 1,235 ft (376 m) above sea level at Charles Mound in the northwestern corner near Dubuque, Iowa. The result is a rich and interesting landscape that can be grouped into three geographic regions. The Central Plains cover most of the state running from Lake Michigan west and south. The Shawnee Hills is a narrow strip of land that rises as you move south from the Central Plains toward the Ohio River. The region is relatively small, however, ranging from 5 to 40 mi (8 to 64 km) wide and about 70 mi (112 km) long, with numerous rivers, valleys, and woodlands. The Gulf Coastal Region is another small area just to the south of the Shawnee Hills and bounded by the Mississippi River to the west and the Ohio to the east. The area is an extension of the Gulf Coastal Plain that extends up from the Gulf of Mexico. The area is generally hilly, although it flattens out somewhat toward the border with Kentucky.

Enriched by numerous rivers, most of which flow to the Mississippi-Ohio system, the broad, level prairies gave rise to the nickname of Prairie State as the early settlers arrived. These rivers also provided early explorers with convenient access to the interior of the continent and played an important role in the settlement of the prairies further west.

With the completion of the St. Lawrence Seaway, Illinois had access to the Atlantic seaboard via the Great Lakes for oceangoing ships. Illinois has been an important transportation hub since the early 1800s. Today, in addition to important water transportation corridors, the transportation complex also includes railroads, airlines (Chicago's O'Hare airport is one of the busiest in the world), and an extensive highway system.

### ILLINOIS HISTORY

The earliest Europeans to visit the area were French explorers and missionaries during the early 1600s who ventured in to lands long occupied by Sac, Fox, and other Native Americans. By 1680, Robert de La Salle had established Fort Crèvecoeur, and although occupation of the area was sparse, the region was highly valued for its fur trade. In 1787, Illinois became part of the Northwest Territories following the signing of the Treaty of Paris at the end of the American Revolution. Illinois became a separate territory in 1809 and a state in 1818.

Industrial development came with the founding of an agricultural implements manufacturing company by



*The prairies of Illinois are tornado country: Above, an F4 strikes Woodford County in central Illinois in 2004.*



Cyrus McCormick in Chicago in 1847 and the building of railroads during the 1850s. The 1850s also saw the rise of a young lawyer named Abraham Lincoln whose arguments against slavery brought national attention and ultimately the American Presidency in 1861. The rapid rise of industry, large inflows of immigrants from Europe, and key transportation connections provided the state with a strong economic base for success.

Rich lands with adequate rainfall and a long growing season make Illinois an important agricultural state. It consistently ranks among the top states in the production of corn and soybeans. Hogs and cattle are also principal sources of farm income. Other major crops include hay, wheat, and sorghum. Beneath the fertile topsoil lies mineral wealth, including fluorspar, bituminous coal, and oil. Illinois ranks high among the states in the production of coal, and its reserves are greater than any other state east of the ROCKY MOUNTAINS. Its agricultural and mineral resources, along with its excellent lines of communication and transportation, made Illinois industrial; by 1880 income from industry was almost double that from agriculture.

Leading Illinois manufactures include electrical and non-electrical machinery, food products, fabricated and primary metal products, and chemicals; printed and published materials are also important. Metropolitan Chicago, the country's leading rail center, is also a major industrial, commercial, and financial center. The Chicago suburbs have also become important business centers. There are cities scattered across the northern half of the state with specialized industries—Elgin, Peoria, Rock Island, Moline, and Rockford, while the industrially important cities in central Illinois include Springfield and Decatur.

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## immigration

ALIENS OR NONCITIZENS who reside or seek to reside temporarily or permanently within the borders of a country are generally termed as immigrants. The term *immigrant* refers to someone who enters a country, while the word *emigrant* refers to someone who leaves a country. In the early times, the tendency was to look upon the alien as an enemy and to treat him or her as a criminal and outlaw. Aristotle, probably reflecting the common view in the ancient world, saw non-Greeks as barbarous people who were slaves “by nature.” The *jus gentium* of the Roman law applied to both citizens and foreigners and tended to favor the idea that aliens had rights; humanity toward aliens was also fostered, in theory at least, by the Christian idea of the unity of all persons in the church. The legal and ideological expression of humanity toward the alien, however, is a relatively modern development.

As sovereign national states began to take shape, the founders of international law asserted that natural rights were vested in all persons, without regard of citizenship or alienage, rights of which they ought not to be deprived by civilized societies or their governments. There was no general agreement on the content or scope of these natural rights as they affected aliens, but the existence of some minimum standard of civilized treatment was asserted. The minimum standard, it was conceded, did not include the right of aliens to own property or to engage in gainful professions. To meet this situation, states entered into treaties which provided that each of the contracting states would treat the nationals of the other state on an equal footing with its own nationals in the admission into trades and professions, ownership or possession of property, access to courts, enjoyment of liberty of conscience, and freedom of worship. Some treaties do not claim to extend to aliens, however, rights that are by municipal law reserved exclusively to the nationals of the country; thus municipal law, rather than conventional international law, is actually controlling. In particular the desire of nations to protect citizens in their jobs, professions, and businesses against both unemployment and competition is a very strong force restricting the latitude of aliens.

With the discovery of new and unsettled continents, steps were taken by European countries to colonize and populate these lands. The UNITED STATES, CANADA, AUSTRALIA, NEW ZEALAND, ARGENTINA, and BRAZIL have been the principal immigrant-receiving countries. The common economic needs of nations, on

the other hand, have had some liberalizing effects on the immigration process and the treatment offered to immigrants. The treaties constituting the EUROPEAN UNION, for instance, provide that citizens of member states should be free to reside in any signatory country. The United States has a long history of immigration, from the first Spanish and English settlers to arrive on the shores of the country to the waves of immigration from Europe in the 19th century to immigration in the present day. The history of immigration to the United States of America is, in some senses, the history of the United States itself, and the journey from beyond the sea is an essential element of the American myth. From early in the 19th century to 1930, at least 60 percent of the total world immigration was to the United States. Of a total immigration to the United States of 41 million persons admitted from 1820 to 1960, 34 million were from European origin.

The population of the colonies that later became the United States grew from zero Europeans in the mid-1500s to 3.2 million Europeans and 700,000 African slaves in 1790. At that time, it is estimated that three-quarters of the population were of British descent, with Germans forming the second-largest free ethnic group and making up some 7 percent of the population. Between 1629 and 1640, some 20,000 Puritans emigrated from England, most settling in the New England area of North America. From 1609 to 1664, some 8,000 Dutch settlers peopled the New Netherlands, which became New York and New Jersey.

Between 1645 and 1670, some 45,000 Royalists and/or indentured servants left England to work in the Middle Colonies and VIRGINIA. From about 1675 to 1715, the Quakers made their move, leaving the Midlands and North England behind for PENNSYLVANIA, NEW JERSEY, and DELAWARE. The Quaker movement became one of the largest religious presences in early colonial America. Germans migrated early into several colonies but mostly to Pennsylvania, where they made up a third of the population by the time of the Revolution. Between about 1710 and 1775, about 250,000 Scotch-Irish, mostly Presbyterian Protestants of Scottish descent from Northern Ireland, immigrated to and generally settled in western Pennsylvania and in Appalachia and the western frontier, which later would become KENTUCKY and TENNESSEE.

## LAWS REGULATING IMMIGRATION

Prior to World War I, the laws of the United States permitted immigration without numerical limitation and were concerned chiefly with barring undesirables. The

initial limitations upon immigration prohibited the importation of oriental slave labor, prostitutes, and alien convicts, pursuant to laws enacted in 1862 and 1875. The mentally ill, epileptics, physical defectives, tubercular persons, anarchists, beggars, those likely to become public charges, Chinese laborers, contract laborers, those suffering from loathsome or dangerous diseases, polygamists, paupers, persons whose passages were paid by others, and aliens convicted of crimes involving moral turpitude were added by successive enactments in 1882, 1855, 1891, 1903, and 1907. In 1907 an agreement was concluded with JAPAN limiting the entry of labor from that country. In the same year an immigration commission was appointed; its report in 1911 led to the Immigration Act of 1917, which remained one of the basic immigration statutes until its repeal by the Immigration and Nationality Act of 1952 (the McCarran-Walter Act). To the class of aliens previously inadmissible were added Hindus and other Asians, illiterates, persons of constitutional inferiority, those seeking entry for an immoral purpose, alcoholics, stowaways, and vagrants. The 1917 act was proposed as a restrictive measure to stem the tide of free immigration of the past.

A temporary quota law, restricting the number of admissible aliens, was enacted in 1921. This was followed by first permanent quota law in 1924. Under the 1924 immigration act and presidential proclamation issued thereunder, quotas were distributed on the basis of national origin of the population of the United States in 1920. Aliens seeking entry into the United States were divided into three categories: those racially ineligible for citizenship (Asians) were barred from permanent admission; those who were born in the Western Hemisphere countries came in without any quota limitation; all others were subject to a numerical limit assigned on the basis of their country of birth. Thus, immigration from northern and western Europe was encouraged and immigration from the southern and eastern parts discouraged. The 1924 act also initiated the visa requirement; that is, the procuring of a permit from a U.S. consular officer abroad as a condition to immigration to the United States. In 1940 Congress promulgated a law requiring the finger printing and registration of aliens.

In 1952, the U.S. Congress enacted the McCarran-Walter Act, known as the Immigration and Nationality Act of 1952, which retained the nation-origin quota system, though it eliminated race as a complete bar to immigration. In addition to these permanent immigration laws, the United States has enacted temporary

statutes authorizing the admission of refugees. Immigrants who are admitted legally to the United States may be certified and granted "green cards" that entitle them to rights that include employment. But they are still subject to limitations under local laws. The immigrant in the United States is afforded a large measure of economic opportunity; he may invoke the writ of habeas corpus; in criminal proceedings he is entitled to the guarantees of the Bill of Rights; and his property can not be taken without just compensation. But to remain in the country "is not his right" but is a matter of "permission and tolerance." As long as an immigrant is in the United States, the Constitution is his protection; but Congress, not the Constitution, decides whether or not he is to remain.

The laws of the various nations of the world regulating the admission and exclusion of aliens seeking permanent residence differ considerably. Marked contrast also appears in the manner in which immigration laws are administered. In the United States, prior to 1940, the Department of Labor administered and enforced the exclusion and deportation laws, whereas in Australia, the minister of trade and customs is in charge of the issuance of landing permits and the admission of aliens. In New Zealand the immigration laws are administered by the customs department. In Brazil the minister of foreign relations supervises immigration.

Most countries impose no numerical restrictions or quotas on the entry of aliens but enacted preferential systems to maintain designated racial characteristics of the population of the countries employing such policies. The United States, through its quota system, favors immigration from countries of North and South America and northern and western Europe. Australia's preference is for the British stock; Canada leans to persons from the UNITED KINGDOM and FRANCE; Argentina prefers the nationalities of its early settlers, including the Spanish, Italian, Portuguese, German, and Swiss. Brazil gives preferential treatment to Portuguese and to a lesser degree to Italians and Spanish. A number of countries have established educational qualifications for entry; however, England, Brazil, Argentina, and many other countries have no literacy limitations.

Many countries have set forth financial qualifications in their immigration laws. Under the laws of the United States an alien must establish to the satisfaction of U.S. consul abroad and to immigration authorities upon arrival that he will not become a public charge. This is done by proof of his financial resources or by affidavits demonstrating that he will have employment.

England, Australia, and Canada have similar provisions excluding those who are likely to become a public charge. New Zealand authorities bar even British subjects by reason of economic conditions. Brazil can exclude immigrants who do not have sufficient funds. Furthermore, physical and in some cases mental conditions are grounds of inadmissibility under the laws of several nations. Also, persons with criminal records and immoral aliens, such as prostitutes and procurers, may be denied entrance to many countries. Very few countries require aliens to serve in their military forces. In the United States, every male alien admitted for permanent residence who is between the age of 18 and a half and 26 is subject to military service. Visitors of this age group who are in the country for more than a year are likewise required to serve but may be exempt from a claim of alienage, which forever debars them from citizenship and permanent residence.

Aliens admitted to the United States for permanent residence are authorized under the immigration laws to engage in any occupation. However, some states laws require U.S. citizenship as a prerequisite to practicing certain professions such as law, medicine, dentistry or engineering. Generally, U.S. citizenship is required for many positions in federal and state governments. Visitors are not permitted to engage in employment in the United States without the permission of the U.S. Citizenship and Immigration Services. Aliens may own real estate and other property and are permitted access to the courts. They do not have the right to vote. In Canada, domiciled aliens are accorded all the civil rights of citizens except the right to vote or hold public office. In New Zealand aliens may acquire both real and personal property and may even vote in municipal elections. Foreigners generally enjoy the same civil rights as citizens in Argentina but are restricted in the practice of certain professions.

## ILLEGAL IMMIGRATION

The world has come a long way from the mercantilist days when nations competed for immigrants. Throughout the 20th century, tight restrictions have been placed on entry. Population pressures, intensified nationalism, and increased ease of movement have all contributed to fears of uncontrolled immigration. One consequence of laws restricting the number and ethnicity of persons entering the United States is a phenomenon referred to as illegal immigration, in which persons enter a country and obtain work without legal sanction. In some cases, this is accomplished by entering the country legally with a visa, and then simply choosing not to

leave upon expiration of the visa. In other cases, most notoriously Mexicans in the United States without legal sanction, people enter the country surreptitiously without ever obtaining a visa. Often, people entering in this fashion are economic refugees, a class of refugee not recognized by the U.S. Citizenship and Immigration Services; these persons have left their home country in a desperate bid to provide financial support for themselves and/or their families. This is particularly true in cases where “minimum wage” in the United States is several times what the average laborer earns in a given country; such immigrants often send a substantial part of their income to their countries and families of origin.

### IMMIGRATION IDEOLOGY

Much of the controversy today with immigration to the United States involves anti-illegal immigration ideologies. Critics of these ideologies say that those who call for an end to “illegal immigration” really advocate an end to all immigration but do not realize it. This occurs for two reasons: 1) all the problems associated with illegal immigration (race to the bottom in wages, etc.) also apply almost equally to legal immigrants; and 2) anti-immigrant ideologues allegedly misunderstand the immigration process and do not realize that many immigrant workers—who they see as replacing American citizens in jobs they can do—have immigrated completely legally, albeit without citizenship (this number exceeds the number of illegal immigrants on a per-country basis).

At the dawn of the 21st century, the controversy revived when many high-tech and software-engineering workers started to arrive from INDIA on “H1” visas. Critics claimed that these people worked for less money and displaced American citizens. The companies who imported the workers usually argued that the United States lacked enough American citizens to do the work.

A few economists argued that, whatever the truth of that assertion, importing the workers provided more benefits to the United States, and otherwise the recruiting companies would simply offshore the entire operation to India itself. This would likely prove worse for the U.S. economy as a whole, because in the first scenario Indian workers living in the United States would at least spend money in the United States, while the supranational corporations that would purportedly export the jobs to India would probably not pass down as much of the savings to the U.S. consumer who purchased for them.

The industrialized nations of the world have adopted policies to defend themselves against influxes from the struggling reaches of the THIRD WORLD. The Federation of American Immigration Reform, which favors reduced immigration, estimates that just to keep pace with the population, the nations of Latin America must create more new jobs each year than the United States has ever succeeded in doing in a single year. Similarly, the International Labor Organization projected that the workforce of the third world countries grew by 600 to 700 million between 1980 and 2000, more than the current total jobs in all industrialized countries combined. Many people in the developed world fear that they are simply losing control. There are serious objections raised on economic grounds. Most visible is the taking of jobs by newcomers, but the prominent question, of course, is the balance between jobs taken and jobs created.

### RULES AND REGULATION

The whole debate about immigration led to tighter entry rules and regulations. Thus, when legal immigration from the Western Hemisphere was for the first time subjected to strict limits in 1968, illegal immigration predictably soared. The U.S.-Mexico border is notoriously porous, and there is a suspicion on both sides of the immigration debate that certain economic interests want in that way. Clearly more could be done to curb illegal immigration. Deportation laws contain wide variations. It has been estimated that there are 700 different grounds for deporting or expelling aliens from the United States. Aliens who enter illegally, overstay their visits, become public charges, commit crimes involving moral turpitude, engage in immoral conduct, or are considered subversive may be deported. Except for those who become public charges, an alien may be deported no matter how long he has been a resident of the United States. He secures a hearing and may appeal to the Board of Immigration Appeals in the Department of Justice and to the courts.

In Canada, aliens who enter illegally or overstay a visit, become connected with prostitution; are convicted of criminal offenses; become public charges or inmates of an insane asylum or of a public charitable institution; or are considered subversive are subject to deportation. A hearing is held with an appeal to the minister of mines and resources. Aliens who enter legally as landed immigrants and remain in Canada for five years may not be deported except for subversive grounds. In England, when an alien is tried for a crime for which imprisonment may be imposed, the court



can impose deportation in addition to or in lieu of the criminal sentence. In Australia, an alien may not be deported after he has maintained a residence of three years. In Brazil, aliens who are married to citizens and who are responsible for the support of citizen children may not be deported.

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## imperialism

FEW TOPICS ARE MORE emotion-provoking than imperialism, which many consider to be a product of the 20th century and of Europeans. Nothing is further from the truth. By definition, imperialism is the act of imposing one's will (personal or national) on another culture or state to create an empire, or an empire is the consequence of the political act of imperialism. *Imperare* is Latin and means "to rule or to command."

The geographic aspect of imperialism was for one country (sometimes even a mercantile city) to rule over widely spaced geographic areas. The person who ruled such areas was referred to as emperor or empress. Unfortunately, in recent times it has been common to use the term as a political epitaph, and generally incorrectly. However, any time one country seeks to impose its political authority on another, it is, by definition, an act of imperialism.

The most recent examples of imperialism include the U.S. application of massive military and technology to impose its values on countries around the world, most demonstrably in IRAQ and LIBYA. Others include al Qaeda and even the Wahabbis of Saudi Arabia, who

seek to control the values and behavior of Muslims around the world.

History is filled with empires and imperialism. Those created by the Chinese, the Persians, the Romans, the British, the Russians, various Africans, and even the Incas are only a few of the better known examples. In virtually all cases, these "empires" and their "imperialism" affected areas and peoples contiguous to the borders of the ruling country or monarch. But of interesting contrast is that there was no Greek Empire. Greeks had empires created by city-states such as Athens or Corinth, but they were dispersed around the Mediterranean, similar to other commercial maritime empires such as those of the Dutch, Portuguese, Spanish, and British.

It is common to refer to the 15th century's Age of Discovery as the Age of Imperialism. The two processes did go together for Europeans. Certainly the major distinction between this age of imperialism and imperialism of earlier times was its geographic extent. At no other time in history did the process of imperialism reach around the globe and impose political authority on such disparate peoples and cultures, most wholly unrelated to the political center. Thus, we found the small country of Holland creating the Dutch Empire, reaching from the Caribbean to the islands of INDONESIA. It was truly said that the sun never set on the British Empire.

Imperialism is not a European invention or practice, but rather it is a political practice, normally generated by economics found at all time periods and in all geographic areas. From the Scythians to the Mongols to the Chinese, all had empires in their time.

### IMPERIAL ECONOMICS

What generates imperialism? Many like to think solely in terms of political power, even conspiracy theories. In fact, history demonstrates that the primary motive has been and continues to be economics. In this context, one can use a modified version of the geographic model that explains trade to also explain empires. That is, there must be complementarity (something one area has that the other wants: raw materials, ports, etc.). This should be unique and not available elsewhere close (no intervening opportunity).

The modern version, with strong historic precedents, are multinational companies that seek dominance (control) of markets or raw material (oil is the most prominent today, but McDonald's, Coca-Cola, and Microsoft are relevant as well). Thus, political imperialism becomes cultural imperialism.

The primary factor in the demise of empires was their geographic extent and their demographic and cultural diversity. There never has been any administrative or social system that could hold the inherent diversity of an empire together. Only when the empire becomes a nation, such as CHINA or the UNITED STATES, and remains geographically contiguous does it seem to last.

The voluntary version of empire, a federal state, in which member parts voluntarily join together for mutual benefit, also reveals strains that so far have prevented its long-term survival. Current examples would include the EUROPEAN UNION, the Russian Federation, and the United States. All have central governments for purposes of national defense and economics, and all face strains of the parts chafing against lost local independence.

No empire can exist without a significant and efficient transportation and communication system. Every early empire had a system of “royal” roads: EGYPT, Mesopotamia, Persia, China, JAPAN, the Mongols, Rome, the Incas, the Ottomans, and Islam. Maritime empires from the Phoenicians and Greeks to the Venetians, Genoese, Spanish, Portuguese, Dutch, and British all fought for dominance and control of key shipping routes, CHOKe POINTS, and harbors. In many instances, use of these “highways” was limited to official couriers.

In addition, every empire required an involved system of administrative centers and officials. Most often, these were existing cities and often local officials were co-opted to serve the new rulers. In addition, empires required records and legal systems as well as warehouses and systems for collecting taxes and sending goods and money to the imperial capital. This in turn created bankers and merchants.

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## India

**Map Page** 1123 **Area** 1,284,215 square mi (3,287,590 square km) **Population** 1,049,700,118 **Capital** New Delhi **Highest Point** 28,201 ft (8,598 m) **Lowest Point** 0 m **GDP per capita** \$462 **Primary Natural Resources** coal, iron ore, manganese, mica, bauxite.



INDIA IS LOCATED in South Asia bordering the INDIAN OCEAN, ARABIAN SEA, and the BAY OF BENGAL in the south. It has a 4,375-mi- (7,000-km-) long coastline. India, with a rich and long history, is one of the oldest civilizations of the world. The Indus Valley civilization, which flourished in the Indus Valley crescent, is almost 5,000 years old. This agricultural surplus-based civilization had urban and advanced culture. As India was very rich in natural resources, it was continuously invaded by foreign powers. Around 1500 B.C.E., the country was invaded by Aryan tribes from the north-west.

They brought and proliferated their religion, which was later known as Hinduism. The Aryan tribes also introduced the hierarchy of society based on four-caste system: Brahmins, Kshatriyas, Vaishyas and Sudras. The concept of the caste system still persists among the Hindus. Interestingly, as most of the Muslims and Christians in India are converted from Hinduism, many of them have retained their caste distinction. In 711 C.E., India was again invaded by Arabs, followed by Turks in the 12th century. During their long reign, a new feature in the form of Islam religion was introduced in the society.

By 1757, Great Britain had virtually assumed political control over a large part of India. The Indian society yet again was fused with many different elements of the Western world. India finally got its independence from Britain in 1947. However, the Indian subcontinent was divided into two different countries—India and PAKISTAN. India is full of imprints transmitted by diverse racial, religious, and cultural groups, which shaped the Indian culture and society as it exists in the present era.

India is slightly more than one-third the size of UNITED STATES and comprises 28 states and seven Union Territories with diverse physical characteristics. The entire country can be divided into four principal physiographic regions. They are:

1) The Deccan Plateau in the south and center, which is a part of the ancient Gondwanaland. It consists of numerous mountain ranges, mesalike Deccan lava country, and scarplands, and rift valleys.

2) The lofty HIMALAYAS in the north, which were formed in the recent geological era (Tertiary) and support 20 of the highest peaks of the world. The Himalayas rose from the floor of the sea, called Tethys, as a result of pressure from the Indian Plate moving northward and colliding with the Asian Plate. The Himalayas are 1,491 mi (2,400 km) long and are a sequence of parallel or converging ranges intersected by gigantic valleys and widespread plateaus.

3) The great Indo-Gangetic plain, in the north-central part, is a gently sloping land intercepted by the landforms imprinted by rivers. Scholars confirm that the great crescent of alluvium from the delta of the INDUS RIVER to that of the GANGES RIVER represents the infilling of foredeep warped down between Gondwanaland and the Himalayas. The depth of the alluvium at places surpasses 6,000 ft (1,829 m). The plains provide the most fertile land for agricultural use.

4) Coastal plains border the coasts of the plateau in the west and east. These physiographic divisions not only give rise to diverse landforms, but also fabricate assorted human responses to the use of land and resources.

India is drained by many mighty river systems. Rivers, particularly the Ganges (Ganga), are considered sacrosanct in India, and several religious towns have developed at the bank of these rivers. Varanasi, by the side of the Ganges, is considered the most sacred of the Hindu pilgrimage places. The rivers of India originate either in the Himalayas or in the Deccan Plateau. The Himalayan river system of the Ganges and Brahmaputra is younger than its plateau counterpart. The rivers are engaged in swift and extensive downcutting, making a steep V-shaped valley in the mountainous stretch of their courses.

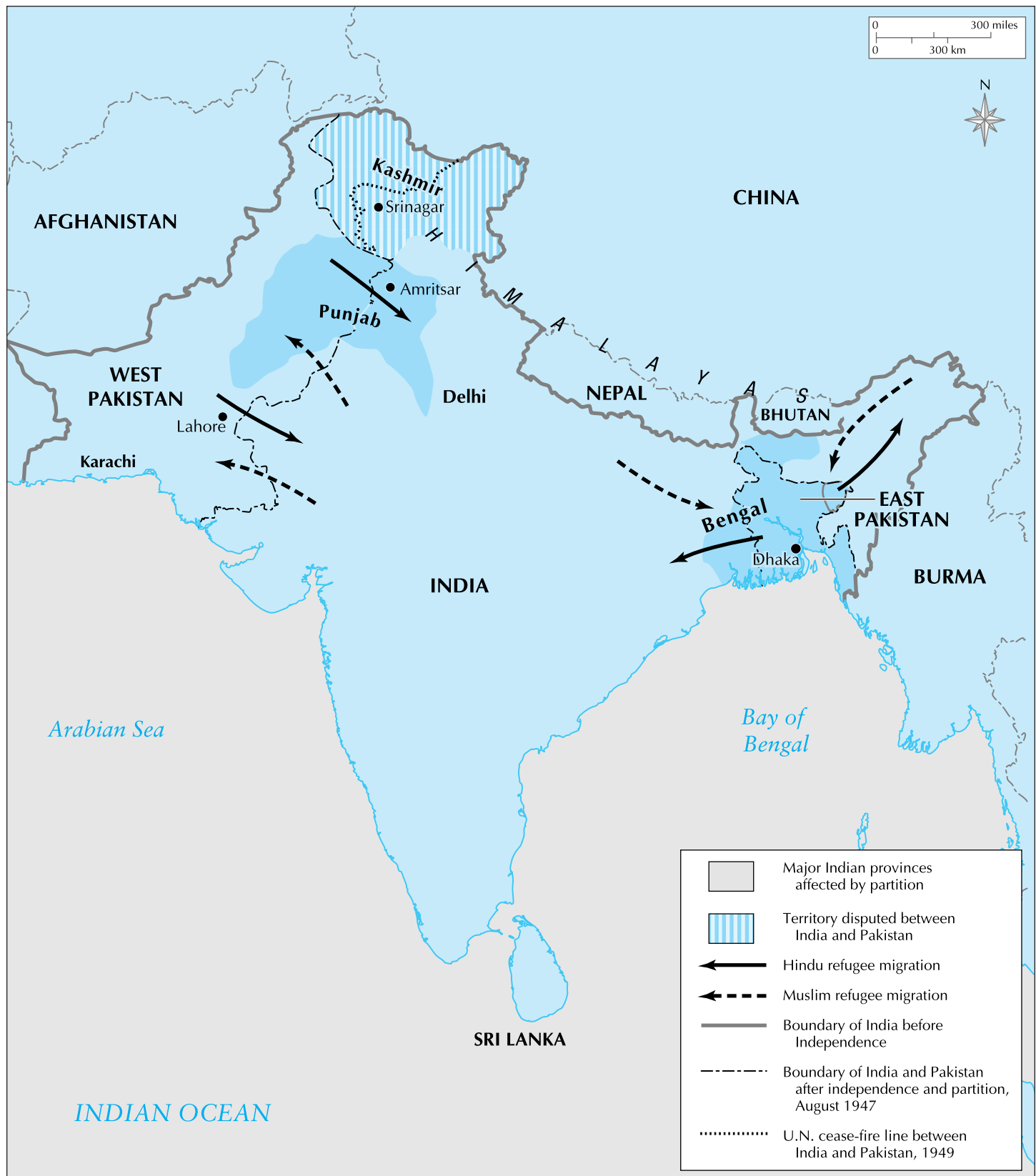
The plateau river systems, Mahanadi, Godavary, Krishna, and Cauvery, are commonly characterized by an older or mature stage, with extensive valleys flowing down the moderate slopes. Narmada and Tapi are the west-flowing plateau rivers, curving through the structural faults. Rivers are incredibly vital for the economic and agricultural development of India. Many of the perennial rivers are utilized for navigation and irrigation. Only some of the rivers are used for hydroelectric power generation.

The climate of India ranges from tropical monsoon in the south and the central part to temperate in the ex-

treme north in the Himalayas. Wet summers and dry winters characterize monsoons. A monsoon climate is actually caused by the differential heating and cooling of land and water in the summer and the seasonal reversal of winds. Indian agriculture is highly dependent on the monsoon rains. As the quantity, timing, and extent of the monsoon rains are extremely erratic, the farmers are fairly undecided about their future. The unpredictable and irregular behavior of monsoons may cause droughts or destructive and extensive flooding, leading to failure of crops. It also results in human and animal deaths. It is from such uncertainty that Indians have developed a belief in fate. Six major climatic regions of India are tropical rainy, humid subtropical, tropical savannas, STEPPE, mountain, and DESERT.

In the tropical rainy region in northeast India and the west coast, the average annual temperature varies from 77 degrees F (25 degrees C) to 80 degrees F (27 degrees C), and rainfall ranges from 78 in (200 cm) to 156 in (400 cm). The region enjoys high rainfall reliability and thus it is less dependent on irrigation. The humid subtropical and tropical regions, covering most of the plateau and Indo-gangetic plain, receive annual precipitation between 39 in (100 cm) and 78 in (200 cm), and average temperatures range from 68 degrees F (20 degrees C) to 77 degrees F (25 degrees C). The region is moderately irrigation dependent. In the tropical savanna region, the annual rainfall varies from 24 in (60 cm) to 32 in (80 cm). Consequently, the region is highly dependent on irrigation for successful agriculture. The mountain region in the north is a narrow strip along the Himalayas and is very cold during the winter and mild in summer. The desert region in the western part of the country has scanty rainfall. No cultivation is possible without irrigation.

India, with a population of some 1.05 billion (2003), is rapidly increasing its number of people. Its total population is second only to that of China. The growth of population was sluggish in the beginning of the 20th century. Nevertheless, since 1921 there has been a large-scale net growth of population. Between 1921 and 1951, the nation's population grew by approximately 1.2 percent annually. However, the stunning growth of population has occurred since the end of World War II. The decade of 1951 to 1961 recorded an annual growth rate of 2.2 percent, increasing to 2.5 percent between 1961 and 1971. Such high growth was part of the post-World War II "population explosion," which was the result of a sharp decline in death rates (8.49 deaths/1,000 population, 2003) and only a gentle decline in birth rates (23.28 births/1,000 popu-



*In achieving independence from the British Empire, the geographic area of the Indian subcontinent was divided into the nations of India and Pakistan. Later eastern Pakistan broke away to form Bangladesh.*



lation, 2003). Currently, the population growth rate is declining (1.47 percent) because of increasing acceptance of family planning methods. The population is highly concentrated in the fertile plains, irrigated lands, and industrial centers.

Indian society is predominantly Hindu (81.3 percent); other believers are Muslim (12 percent), Christian (2.3 percent), Sikh (1.9 percent) and others (2.5 percent). There are 18 official languages. Hindi, the national language, is spoken by 40 percent of the population. "English enjoys associate status but is the most important language for national, political, and commercial communication," explains the CIA *World Factbook*. India has a large number of knowledgeable people proficient in the English language though only 59.5 percent of the total population of the country is literate.

India, since its independence, has maintained a democratic system of government based on free voting rights for persons over the age of 21, making it the largest functional democracy of the world. The economy of India has been maintaining an outstanding average growth rate of 6 percent since 1990. The economy is based on conventional agriculture, contemporary farming, handicrafts, contemporary small- and large-scale industries, and a large number of support services (especially customer support services for multinational high-tech companies). India supports an agrarian economy where 60 percent of the labor force is engaged in agriculture and about 40 percent of national income is earned from it.

The increased population pressure has resulted in immigration and intense cultivation of the arable land more than once in a year, usually referred as double or triple cropping. This, combined with the development of an irrigation system, has resulted in augmented agricultural production. The Food and Agriculture Organization (FAO) has predicted that India can feed triple the size of its 1985 population by the year 2010.

Industries in India are clustered in the specific areas based on the economies of location, leading to five prominent belts. An array of industries ranging from heavy (chemicals, iron and steel, petroleum, textile) to highly skilled (software) provides a strong base to the country's economy. India maintains trading relations with a number of developed countries. The cities of MUMBAI (BOMBAY) and Bangalore, in particular, attained global importance in the development of information technology.

India is developing at an incredibly fast pace with the onset of modern technology. It provides an enor-

mous market to international and national businesses. This colossal growth has adversely affected and polluted the environment. Deforestation, DESERTIFICATION, air and water pollution, and soil erosion are a few of the intense environmental problems experienced by the Indian population. Constantly mounting population pressure is also overstressing the natural resources. In spite of the remarkable gains in economic investment, India has to go a long way to fully stabilize its economy, settle its international disputes, eradicate poverty, control overpopulation, settle ethnic and religious conflicts, and limit environmental degradation.

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## Indian Ocean

MEASURING approximately 26.5 million square mi (68.5 million square km), the Indian Ocean includes the Andaman Sea, ARABIAN SEA, BAY OF BENGAL, Flores Sea, Great Australian Bight, Gulf of Aden, Gulf of Oman, Java Sea, Mozambique Channel, PERSIAN GULF, RED SEA, Savu Sea, Straits of Malacca, Timor Sea, and other tributary water bodies. The ocean is located between Africa, Southern Ocean, Asia, and AUSTRALIA.

The Indian Ocean is the third-largest of the world's five oceans (after the PACIFIC OCEAN and ATLANTIC OCEAN, but larger than the Southern Ocean and Arctic Ocean). The Southern Ocean was delineated in a spring 2000 decision by the International Hydrographic Organization, which consolidated a fifth world ocean from the southern portions of the Atlantic Ocean, Indian Ocean, and Pacific Ocean. This new ocean extends from the coast of ANTARCTICA north to 60 degrees South latitude or the Antarctic Treaty Limit. Five major choke points along commercial sea lanes

provide access to the Indian Ocean. These waterways are the Suez Canal (EGYPT), BAB EL MANDEB (DJIBOUTI-YEMEN), Strait of Hormuz (IRAN-OMAN), and Straits of Malacca (INDONESIA-MALAYSIA), and the Lombok Strait (INDONESIA).

The Indian Ocean has held the historic TRADE ROUTES from Occident to Orient since the dawn of maritime commerce in the ancient world. Spices, slaves, and marvelous though modest handcrafts moved among the many ports the Indian Ocean carried by centuries of monsoon winds and currents. This trade now bears the modern manufactured goods of industrialized nations and the petroleum required to fuel the world's economies. Never an insular sea, the Indian Ocean now serves not only the ports of its own shores but the far reaches of the countries of Europe and the Americas.

Historical accounts include the tales of Egyptian, Greek, and Roman commercial and colonial exploits. The settlement of Madagascar by peoples from Indonesia in ancient times points to the reciprocal flow of culture and commerce from the east. Centuries of trade and exploration were carried out by the Islamic merchants and seaman of the Arabian Peninsula, who took their goods and their faith to the lands of the African coast, India, and Southeast Asia. Before the Europeans made good a sea passage to the waters of the Indian Ocean, Admiral Zheng He of the Ming Dynasty of China led several maritime expeditions across these fated waters from 1405 to 1433.

By 1497, Vasco da Gama navigated around the Cape of Good Hope and began the Portuguese fight for domination of the spice trade across the Indian Ocean. This model of bold commercial venture supported by national navies and prestige was followed by the Dutch, French, and British over the next two centuries. European colonial interests in the Indian Ocean LITORAL continued until after World War II. The independence of regional states from their colonial masters, growth and development among the newly industrialized states, and the increased flows of manufactured goods and petroleum have made the Indian Ocean truly an international sea.

During the Cold War, the Indian Ocean was an arena of competition between East and West. Regional navies were often overshadowed by the number and modern capabilities of the U.S. and Soviet fleets. Establishment of a permanent support and operational base on the island of Diego Garcia, strategically central in the Indian Ocean, was a clear sign of the American intent to remain active in the region. The United States

maintains the most active, modern, and capable military forces in the Indian Ocean.

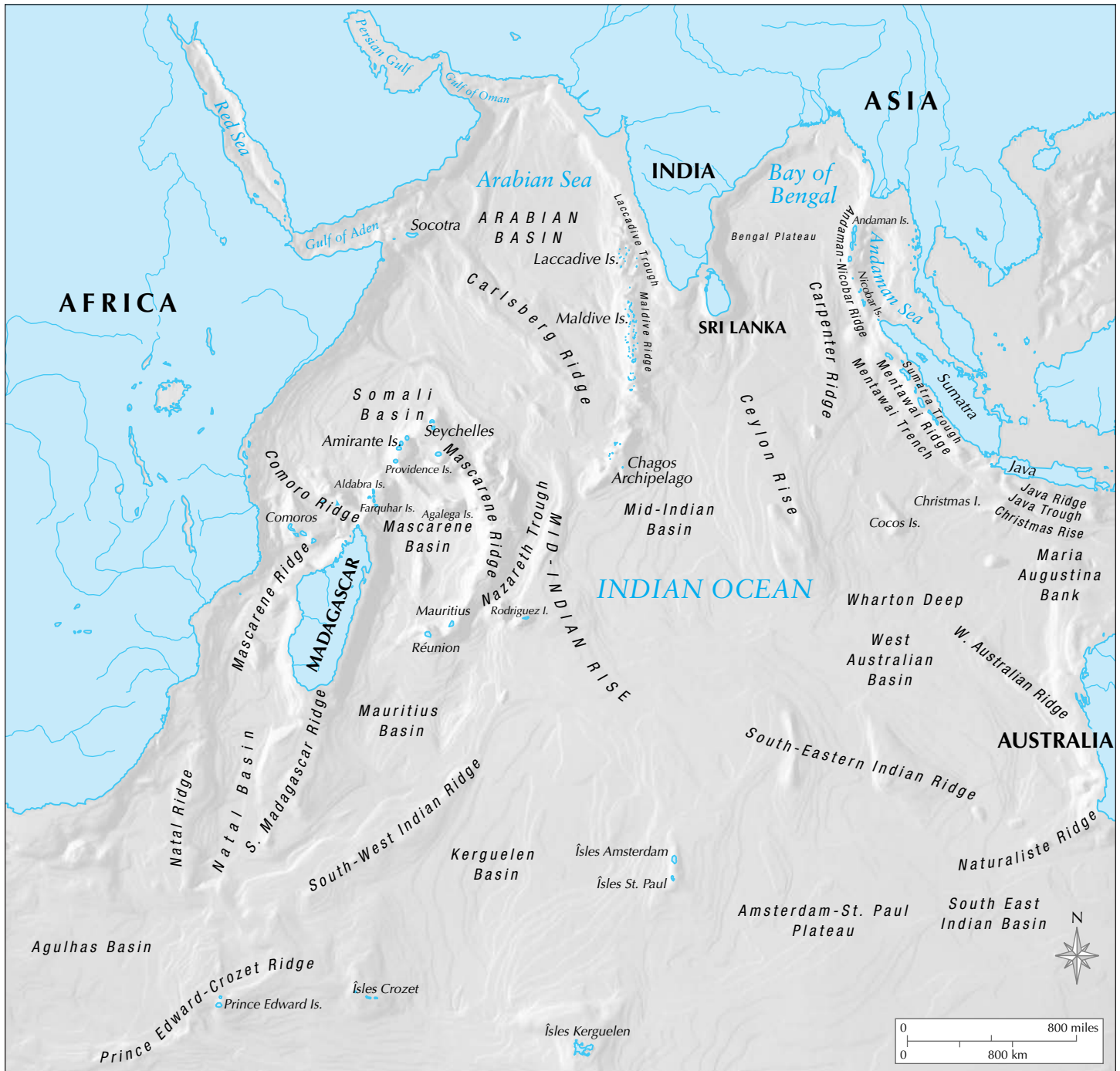
Throughout the long history of foreign economic exploitation and domination, the Indian Ocean has continuously been a rich resource to the peoples of the region. It constantly supplied transportation routes and rich fisheries along the coasts. The Indian Ocean continues to be a major fishing ground with fleets from many nations vying for the limited resource. Fishing stocks are being depleted by a combination of overfishing and pollution along the Indian Ocean coasts. The overexploitation of fish stocks is mostly due to large fishing vessels operating illegally near the coast. The growth of regional populations, particularly in INDIA and Indonesia, will add pressure on the already challenged marine resources.

This population increase and industrial development creates major pollution problems in the most critical fishing areas. Industrial effluents contain heavy metals and chemical wastes. Pesticides and organic wastes flow untreated into the coastal waters from cities and agricultural land. Oil pollution from accidents, ballast dumping, and offshore oil extraction is on the increase. The nations that share the management and use of the Indian Ocean have no comprehensive plan for conservation and management of the resources or uses of this global asset.

Mineral resources and especially offshore petroleum extraction are continuing to grow as a commercial interest to nations. Large reserves of hydrocarbons are being tapped in the offshore areas of SAUDI ARABIA, IRAN, INDIA, and AUSTRALIA. An estimated 40 percent of the world's offshore oil production comes from the Indian Ocean. Beach sands rich in heavy minerals and offshore placer deposits are actively exploited by bordering countries, particularly India, SOUTH AFRICA, Indonesia, SRI LANKA, and THAILAND. The mining of polymetallic nodules from the seabed remain a tempting, but technologically challenging operation.

Climate and weather patterns are dominated by the annual monsoon. This weather cycle is attributed to low atmospheric pressure over Southwest Asia created by hot, rising summer air, which causes southwest-to-northeast winds and currents during the summer months. A high pressure over North Asia created by cold, falling, winter air results in northeast-to-southwest winds during the winter months.

For half the year (April to October), the winds in this region are from the southwest, reversing in the other half of the year. This monsoon (season) weather pattern dominates the region on land and sea, setting



The eastern Indian Ocean, near Sumatra, was the site of a major underwater earthquake, registering 9.0 on the Richter scale, on December 26, 2004. The resulting tsunamis, or tidal waves, killed thousands along the Indian Ocean's land borders, from Indonesia to Africa.

the pace of life onshore and off. Tropical cyclones occur during May/June and October/November in the northern Indian Ocean and January/February in the southern Indian Ocean.

Primary adjoining arms of the Indian Ocean are the Persian Gulf and the Red Sea. The deepest known

point is 25,443 ft (7,758 m), off the southern coast of Indonesia in the Java Trench. The Indian Ocean contains numerous islands, the largest of which are MADAGASCAR and SRI LANKA. Smaller islands that constitute independent countries include the MALDIVES, the SEYCHELLES, and MAURITIUS. The major rivers that flow

into the Indian Ocean include the waters of the Limpopo and Zambezi rivers from Africa, as well as the IRRAWADDY, Brahmaputra, GANGES, and INDUS from east to west along Asia. The combined waters of the Tigris and Euphrates rivers mix with the Indian Ocean via the Persian Gulf.

The Indian Ocean is of geostrategic interest as it is a transit route for a major portion of the world's oil supply. In addition the commerce flowing by ship from Asia to Europe also sails this sea. Some major ports and harbors of the Indian Ocean are Chennai (Madras; India), Colombo (Sri Lanka), Durban (SOUTH AFRICA), JAKARTA (Indonesia), KOLKATA (Calcutta; India), Melbourne (Australia), MUMBAI (Bombay; India), and Richards Bay (South Africa).

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## Indiana

KNOWN AS THE Hoosier State, the north central state of Indiana ("Land of Indians") was formed from the Northwest Territory in 1800 and entered the Union in 1816 as the 19th state. Roughly rectangular in shape, Indiana is approximately 270 mi (434 km) north to south and 140 mi (225 km) east to west. The geography of Indiana encompasses 36,420 square mi (94,327 square km), which makes it the 38th largest state in the UNITED STATES. It is 14th in population. Indiana is bounded on the north by Lake MICHIGAN and MICHIGAN, on the south by KENTUCKY, on the east by OHIO, and on the west by ILLINOIS. In addition to Indianapolis, the capital, Indiana's largest cities are Fort Wayne, Evansville, South Bend, Gary, Hammond, Bloomington, Muncie, Lafayette, and Anderson.

Most of Indiana has a humid continental climate, with four distinct seasons, resulting in long, warm summers and cool winters. The southernmost area of the state has a humid subtropical climate, experiencing more frequent rainfall and less extreme temperatures in

the winter. Northern Indiana may experience up to 40 in (101 cm) of snow in the winter, but the southern sections rarely receive more than 10 in (25 cm) a year. Temperatures range from highs of 70 to 80 degrees F (21 to 26 degrees C) to lows of 25 to 35 degrees F (-4 to 2 degrees C). The state experiences an annual precipitation rate of around 40 in (101 cm). Tornadoes are likely in the spring.

Indiana is divided into three geographic areas: the Great Lakes Plains of northern Indiana, the Till Plains found in central Indiana, and the Southern Plains and Lowlands of southern Indiana. The Great Lakes Plains contain large sand dunes along the shores of Lake Michigan. This landscape varies from flat to gently rolling areas, interspersed with a number of lakes and bogs. The soils in this area are generally acidic grays and browns.

The Till Plain is part of the Midwestern Corn Belt. The acidic gray and brown soils found in the low hills and valleys produce extremely fertile land. The more rugged terrain of the southernmost part of Indiana is located in the Southern Plains and Lowlands, which is covered by steep hills known as knobs. This area is home to a number of well-known caves, such as Wyandotte and Marengo Caves, and mineral springs such as those found in West Baden and French Lick.

Elevations in Indiana range from 320 ft (97 m) above sea level at the Ohio River to 1,257 ft (383 m) above sea level at Hoosier Hill. Bordering on Lake Michigan, Indiana lays claim to approximately 230 square mi (595 square km) of this major water source and to a 41-mi (66-mi) shoreline. Other Indiana rivers include the Ohio River, the Wabash River and its tributaries, the White River and the Tippecanoe River, and the Kankakee River. Saint Joseph and Saint Mary's rivers converge at Fort Wayne in northeastern Indiana. The state's major lakes include Michigan Lake, Wawasee Lake, and Monroe Lake.

Approximately 4.5 million acres of Indiana's land area are forested, including the Beech-Maple Forest, the Oak-Hickory Forest, the Southern Floodplain Forest, and the Elm-Ash Forest. Indiana forests provide a home to tulip (the state tree), oak, hickory, maple, walnut, ash, spirea, barberry, and mock orange trees. Wildflowers include peony (the state flower), violet, daisy, columbine, gentian, trillium, and various kinds of orchids. Abundant wildlife in Indiana includes whitetail deer, raccoon, opossum, gray fox, coyote, beaver, rabbit, squirrel, skunk, muskrat, mink, and weasel. Bobcat and badger have been identified as endangered species in Indiana. The state's game birds in-



clude wild turkey, ruffed grouse, quail, and pheasant. Sparrows, blue jays, wrens, and cardinals (the state bird) are found throughout the state. Indiana is also home to 75 species of endangered birds, such as the peregrine falcon, Kirtland's warbler, and the bald eagle.

As a major industrial center, Indiana specializes in the iron, steel, and oil products industries. Bituminous coal, found mostly in southwestern Indiana, is also a major revenue producer for the state. Manufacturing in Indiana also includes the production of transportation equipment, motor vehicles and equipment, industrial machinery and equipment, electric and electronic equipment, mobile homes, farm machinery, wood office furniture, and pharmaceuticals.

The state's major crops are corn, soybeans, wheat, oats, rye, and nursery and greenhouse products. Other successful agricultural activity revolves around the production of tomatoes, onions, popcorn, fruit, hay, tobacco, mint, and livestock. Oak, tulip, beech, and sycamore are the chief products of Indiana's timber/lumber industry.

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## Indonesia

**Map Page** 1124 **Area** 741,110 square mi (1,919,440 square km) **Population** 238,452,952 **Capital** Jakarta **Highest Point** 16,502 ft (5,030 m) **Lowest Point** 0 m **GDP per capita** \$3,200 **Primary Natural Resources** petroleum, natural gas, nickel, copper.



COMPOSED OF 17,000 islands, Indonesia is the world's sixth-largest nation and the world's largest archipelago, stretching over 5,000 mi (8,047 km) along the equator. It lies southeast of the Malay Peninsula and Indochina. AUSTRALIA is due south and the PHILIPPINES lie to the north. About half the population lives on the island of JAVA where the capital, JAKARTA, is located. The island of BORNEO is shared with MALAYSIA, while New Guinea is shared with PAPUA NEW GUINEA. Other larger and populated islands are SUMATRA and Sulawesi.

### EARTHQUAKES AND TSUNAMIS

Because of its location on the edges of tectonic plates, Indonesia is prone to earthquakes, which cause TSUNAMIS (as exemplified in the 2004 tsunamis that violently hit the island of Sumatra). Indonesia also has many volcanoes. Terrain of the islands varies and includes mountains, rainforests, and miles of beaches. The country has a hot, humid tropical climate, with a more moderate climate in the highlands.

There are two seasons: the dry season from June to October, and the rainy season from November to March. It is hot all year round, although coastal regions are cooler. Indonesia is home to a wide variety of flora and fauna. Elephants, tigers, leopards, and orangutans live there, as well as sea turtles and Komodo dragons. The world's largest flowers grow in Sumatra. Unfortunately, rainforests are rapidly disappearing from the region.

Indonesia's history has added to its rich diversity of culture. From the 7th to the 14th century, Hindus and Buddhists formed several kingdoms on these islands. Arab traders later introduced Islam. In the early 16th century, Europeans in pursuit of the spice trade arrived. By the 17th century, the Dutch were the dominant colonial force in the region. Indonesia was still under Dutch rule when World War II broke out.

During the war, Japan conquered and occupied the Dutch colony. They found the Indonesian elite to be cooperative and several were decorated by the Japanese emperor in 1943. After the war, a group led by Sukarno declared the country's independence. The Dutch attempted to quell the independence movement and regain control of Indonesia. After several years of bloody fighting, the Dutch accepted Indonesia's independence.

Sukarno was the first president. His government, now called the Old Order, saw military conflict with British Malaya and economic difficulties at home. In 1967, Army General Suharto took over, saying he



*Indonesian schooners ply the vast seas that lie between the archipelagoes that comprise the country of Indonesia.*

could secure the country against an alleged coup attempt by communists. His 32-year reign is known as the New Order. Suharto's corrupt regime brought wealth to himself and his family, and he was forced to step down in 1998 after massive popular demonstrations against him. During the next three years, the country had three presidents. In 2004, Susilo Bambang Yudhoyono was elected president.

The culture of Indonesia has been influenced by its many immigrants. Most Indonesians are of Malay or Polynesian descent. The population also includes significant numbers from INDIA, CHINA, SAUDI ARABIA, IRAN, and Europe. The official language is Bahasa Indonesia, but English, Dutch, and local dialects are widely spoken as well.

Indonesian art shows influence of other cultures. Javanese and Balinese *wayang kulit* shadow theater shows are popular, as are famous Javanese and Balinese dances. Some islands are famous for their batik and itak cloth. The unique martial art of Silat originated in Indonesia. Indonesia is primarily a Muslim nation, but religious tolerance is widespread. Muslims account for 88 percent of the population, with 8 percent Christian, 2 percent Hindu, and 1 percent Buddhist.

### NATURAL RESOURCES

Indonesia is blessed with a number of natural resources. The country is the second-largest exporter of natural gas. Other natural resources include gold, copper, tin, and oil. Indonesia's agricultural products include rice, tea, coffee, spices, and rubber. The UNITED

STATES, JAPAN, SINGAPORE, Malaysia, and Australia are Indonesia's major trading partners. Agriculture or farming accounts for 45 percent of the workforce, while 16 percent work in industry, and 39 percent in service industries.

Indonesia faces many problems, both economic and social. The judicial system does not function well and the banking system is weak, making Indonesia a poor climate for foreign investment. There are ongoing threats against Western interests in Jakarta. The 2002 terrorist bombing of the Sari nightclub and a bomb explosion outside the Australian embassy in 2004 add to the unrest. Poverty is a problem, particularly in Jakarta. About 27 percent of the people live below the national poverty level.

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## Indus River

THE INDUS RIVER in PAKISTAN flows 1,900 mi (3,000 km) from southwestern TIBET to the Arabian Sea. From the dawn of human culture, the Indus River has sustained societies along its banks; the earliest civilization that can be reliably distinguished is called the Indus Valley civilization (or Harappan). This sophisticated society is dated back to 2500 B.C.E. The Harappan culture was a well organized civilization built upon surplus agricultural production and bolstered by commerce that reached as far Mesopotamia. The nascent agricultural predecessors of the Harappan culture may well reach back into the 5th millennium B.C.E.

The name *Indus* comes from its Sanskrit name *sindhu* (meaning "water, flood, ocean"). The drainage basin of this great river has caught a continuous stream of invaders and conquerors of various ethnic, linguistic, and religious origins. Each of these succeeding groups would wind their way through the mountain barriers and flow down toward the Indus River seeking purchase in its fertile valley. The records of these peoples come to us through spoken and literary traditions

that reach back without break to 2000 B.C.E. The Vedas are a uniquely ancient traditional history that tells us of the Aryan tribal groups of pantheistic pastoralists that supplanted the earlier Harappan culture. This pattern of migration, conquest, and decline would repeat itself over the centuries to follow.

Alexander the Great brought his conquering army to the Indus around 326 B.C.E. and left a lasting impression of Hellenist culture in art of the region. This influence survives in the great Buddhist statuary art treasures that grace the Indus Valley. Buddhism gained dominance with the coming of Ashoka (236 B.C.E.) and his turning of Taxila into a major Buddhist center of learning and culture. The ebb and flow of empires continued with rulers from the east and west vying for control. Buddhist, resurgent Hindu, and then Islamic conquerors ruled until the passing of time brought 15th century Europeans to the Indus River.

The British came as all conquerors before them, but were the first to seek to subdue the Indus River as well as its people. They spent 100 years attempting to harness the irrigation power of the waters. This radically changed the landscape and impacted social and political structures, changes that continue today. The dams and barrages built by the British remain the primary infrastructure to fight annual flooding.

The Indus River shares all the challenges that accrue with major man-made improvements. Dams reduce flows in lower portions of the system and limit the transport of fertile sediments downstream into the DELTA. Dams compartmentalize river systems and isolate aquatic life into smaller communities. Extraction of irrigation water, especially during low water periods can threaten fish stocks. Introduced species often compete with indigenous ones.

Density of population along the Indus and its tributaries combined with an almost total lack of conventional public sanitation systems mean many water courses are little more than sewage carriers at low flow periods. This leads directly to the contamination of drinking water and agricultural produce. Low-lying land is commonly used as solid waste dumping sites contributing to illness and mortality. The vaunted “green revolution” has brought increased food production but also introduced large quantities of fertilizers and pesticides into the waters and sediments of the Indus. Growth of the textile industry and other manufacturing has radically increased the flow of toxic industrial wastes into the riparian system. Pakistan is only in the earliest stages of studying and addressing the sustainment needs of the Indus River.

The head of the Indus rises in southwestern Tibet. It then flows northwest through Kashmir before bending to the south and leaving the mountains to become a slow-flowing, highly braided river course. It is dammed near Peshawar to form the Tarbela Reservoir. The catchment area of the Indus is estimated at almost 386,100 square mi (1 million square km), and all of Pakistan’s major rivers flow into it. In its upper basin of Punjab (meaning “land of five waters”) are the Jhelum, Chenab, Ravi, and Sutlej rivers. Passing by Hyderabad, it ends in a large delta to the southeast of KARACHI.

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## Industrial Revolution

THE INDUSTRIAL Revolution is one of the most dramatic events in modern world history, an event which has more or less influenced all nations of the world in one form or another. The Industrial Revolution began in the late-18th century in England, UNITED KINGDOM, in a region of the country known as the West Midlands—the largest city today in this region is Birmingham.

The Industrial Revolution is characterized by the rise of industrialization, a process of industrial, social, and economic changes that revolutionized societies from agrarian to industrial. Central to this change is the development of technology that allows for the process of manufacture to occur, that is, the changing of raw materials into finished goods (often in factories) for sale in the marketplace. To simply define what is the Industrial Revolution is problematic, but in simple terms, it may be said to be the application of power-driven machinery to the process of manufacturing products.

The Industrial Revolution must be viewed as a revolution, not in the political sense of the word, but a



revolution in that fundamental changes occurred as a result of its existence, particularly in the social and economic structure of countries it affected. The changes that brought about the Industrial Revolution in England occurred in a gradual manner and can be seen in the previous decades and centuries before fundamental change happened. Thus, the Industrial Revolution was the consequence of a long period of change prior to the application of power-driven machinery within the process of manufacture.

### CHARACTERISTICS OF THE REVOLUTION

The Industrial Revolution began in the late 18th century in England. As to the precise date of the event, historians have been unable to provide an answer. Regardless of people's perspectives, what has been widely noted is that from the end of the 18th century, fundamental social and economic change occurred in England and subsequently other places, which included a dramatic rise in national population sizes, brought about by changing birth and death rates; a more rapid growth of existing towns and cities, particularly capital cities; the appearance of new social classes related to people's position as owners of industry or as workers in the industrial process; and developments in transportation and networks of communication.

For the Industrial Revolution to have happened, historians have noted a number of significant changes in society. These have included developments in agriculture, such as the adoption of new systems of cultivation and the invention of new machinery which allowed for an increased supply of food, and the development of new machinery in industrial production from increases in knowledge that were mostly the result of practical experiences and informed empiricism.

These new machines that greatly affected industrial behavior included, by way of example, machines like the flying shuttle (John Kay), the water frame (Richard Arkwright) and the spinning jenny (James Hargreaves). Coupled with this particular development were inventions in other areas that were also applied to modern industry.

For instance, Thomas Newcomen's steam engine, first used to help pump water out of mines, and then James Watts's 1763 steam engine opened the door for steam-powered machinery in the workplace. Steam providing the power for machines that previously had used water as a source of energy. Such inventions helped bring about a dramatic rise in output, in turn stimulating further industrial growth and wider social and economic change.

For the Industrial Revolution to have happened, historians such as Michael Zell have noted an important economic/industrial stage immediately prior to the onset of industrialization. This stage of development, a "putting-out" industrial phase commonly referred to as proto-industrialization, is widely accepted to be the phase of modern economic development that preceded the Industrial Revolution proper.

Proto-industrialization can be characterized by two very distinct features: First, the spread of domestic manufacturing in rural places linked previously remote family groupings to not only regional but national and international marketplaces; second, rural manufacture became so widespread in geographical extent, plus so economically and socially powerful, that it helped push economies toward industrial manufacture in the factory situation, a situation associated with capitalist economics and production in urban centers.

### PUZZLED HISTORIANS

Historians have also been puzzled as to why England became the first nation to be affected by the Industrial Revolution. Despite much fervent discussion and writing on the subject, no one single answer has been produced; instead, a number of suggested reasons have been proposed.

In a general sense, both the economic and political contexts were suitable for rapid societal transition but also a number of other factors were significant. These include the abundance of natural resources that could be used as raw materials in the industrial process (e.g. coal and iron ore); the availability of capital to invest in modern industry; a growing marketplace in part based on domestic population growth, foreign trade agreements, and the expansion of the British Empire; the availability of people to work in factories, many of whom were to migrate from the countryside into existing towns and cities; and people of sufficient intellectual capacity—that is, as managers of industrial units—but also people of ideas who could create new machines, workplaces, systems of industry, etc.

### CRADLE OF INDUSTRY

One of the places known as the "cradle of industry" in the West Midlands region of England is the county of Shropshire. Despite being one of the most rural parts of England, it was in Shropshire that a number of industrial firsts happened, probably as a result of the abundance of raw materials (iron, coal, lead) in the area. For instance, within the area of Coalbrookdale is Ironbridge, where the world's first bridge to be



erected of iron was built. The bridge (built in 1779 by Abraham Darby from a design by Thomas Pritchard) helped bring about improvements in iron smelting that formed an important element in the early phases of the Industrial Revolution. Today, the value of Ironbridge is demonstrated by its World Heritage Site status (given by UNESCO).

Central to the Industrial Revolution was the growth of the factory, a large industrial building within which goods are manufactured. Although the world's first factories were not in England, the establishment of thousands of factories as part of the process of industrialization, some of which employed thousands of people, was central in bringing industrial change. The absorption of large numbers of workers into the factory was not a smooth process, as it involved a new labor routine within the workplace. In addition, some workers in England were so aggrieved by free market principles and the introduction of machinery in the workplace, in that it was a threat to their position of labor, that they destroyed equipment.

The Luddites, as they were known, and their movement gained such notoriety in early-19th century England that machine breaking became a capital crime. Many of the first factories in England were placed in rural locations so as to deter possible Luddite attacks.

### LONG HOURS, LOW PAY

Inside factories in the 19th century, laborers worked long hours for low pay, often in dangerous conditions, so as to maintain mass production (the production of large amounts of standardized goods) and industrial output. The development of the factory system was assisted by numerous technological developments at the end of the 18th century and further inventions in the 19th and 20th centuries.

Developments in machinery able to create power as well as the creation of large looms allowed manufacture to be more efficient. In terms of industrial Britain, the cotton factory was the most common factory type, within which cotton was produced. Raw materials from the Americas and the Caribbean, produced under conditions of slavery by workers taken from Africa until the 19th century, helped allow Britain to produce much prosperity, although this wealth was firmly kept within the hands of the factory owners, who would often invest their profits into establishing more factories. As a consequence, huge industrial empires were created in Britain and also in other countries.

The effect of the Industrial Revolution has been felt worldwide. At first the effects of the Industrial Revolution

spread from England across Europe and into Northern America. However, even in Europe the dates at which different countries industrialized differed because of the influence of localized circumstances. FRANCE, for example, despite being geographically close to England did not industrialize until maybe 60 to 70 years after England (in the mid-19th century). SPAIN, too, did not start to industrialize until this time. GERMANY by this time already had a highly advanced industrial economy.

In other parts of the world, countries did not begin to industrialize until the 20th century. Many of today's economic powerhouses in Asia, such as JAPAN, CHINA and TAIWAN, did not industrialize as such until the mid-20th century. In the case of China, industrialization and economic development did not start in earnest until the change of economic policies by the communist national government toward the end of the 20th century.

The effect of the Industrial Revolution has been to accelerate existing previous social and economic trends. In the case of England, as the first industrial nation, a number of these trends will now be discussed, and the consequences of industrialization also given some attention. The growth of industrialization in England at the end of the 18th century brought massive societal upheaval in the following decades. For example, the national population began to increase markedly. Existing towns and cities also grew dramatically. In England the demographic change was particularly pronounced, but all countries that have experienced industrialization at some time have also experienced marked population growth and urban growth.

### URBANIZATION

With the increase in the national population came a significant increase in the urban population of England and Wales, partly because of the location of factories in urban places so as to utilize economies of scale (land, labor and capital). By the middle of the 19th century (1851), England and Wales already had the majority of their population residing in urban centers.

While the growth in urban populations is an important consequence of industrialization, the changes brought about by the Industrial Revolution established a removal of the medieval or preindustrial urban hierarchy in England and Wales. Places, such as Norwich, Exeter, Shrewsbury, Cambridge, Canterbury, and York, urban places with long established histories closely associated with the church, were pushed down the urban

hierarchy because of the sudden surge of people living in industrial places. Additionally, these places resisted industrial pressure and did not industrialize in the late 18th century. So, although large in size and still of national importance, they were demographically surpassed by other places (that is, those that did industrialize). Whereas prior to industrialization settlements like Norwich and York were at the top of the urban hierarchy in terms of their demographic size, by as early as 1801 their relative importance was declining and by 1851 a new urban hierarchy based on industrial towns and cities at the top was firmly in place. By 1851 industrial places such as Sheffield, Newcastle, Bradford, Hull, and Leeds were positioned at the upper echelons of the urban hierarchy.

### CAPITAL GROWTH

A noticeable consequence of the Industrial Revolution was that it allowed already large urban centers to markedly increase their demographic size and urban regions to appear for the first time. Across Western Europe, for instance, capital cities grew dramatically. London increased its population size from 1.1 million to 6.6 million people between 1801 and 1901. By about 1900, there were approximately 150 large cities (of 100,000 or more people) in Europe whereas in 1800 there had been about 20 places of this size.

The marked shift in urban living has been the source of much investigation, and a number of reasons have been given as to how the Industrial Revolution influenced such change. These include the need to have concentrations of labor in areas close to raw materials where factories would be based (e.g., the Ruhr in Germany), the need for marketing finished products at places with access to rail or water (e.g., Liverpool in England, Hamburg in Germany and NEW YORK, UNITED STATES), and finally the tendency for banking and financial institutions to base themselves in existing political and cultural centers (e.g., PARIS and LONDON).

Examples of urban regions that developed in 19th century Europe include the Ruhr (Essen, Dortmund, Bochum, Dusseldorf) in Germany, and the West Midlands (Birmingham, Coventry, Wolverhampton) in England.

To refer back to British industrial society, the early decades of the 19th century witnessed major changes to the economic, political, social, and aesthetic values of Britain as a consequence of industrialization, urbanization, and demographic transition, which were reflected in the changing appearance and form of urban land. Urbanization not only affected the building in-

dustry but virtually swamped the administrative practices and building codes that had safeguarded the urban environment, as resultant chronic overcrowding, poverty, inadequate sanitation, dirt, and disease were to testify. These were not unusual occurrences, but now they occurred on a scale never witnessed before. In terms of housing much change occurred as well. In order to capitalize on the rush of migrants into towns and cities to work in factories, speculative builders hastily erected poor quality houses within which worker families would reside, and about 99 percent of houses erected in London in the 19th century were done so speculatively.

Significantly, these houses were packed together, often close to the location of local factories, in high-density fashion, which exacerbated social tensions and problems. Disease, for example, was often rife in working people's districts, and often epidemics of diseases such as cholera would kill thousands. Houses were erected without any sanitation, maybe one outside toilet for an entire street, and without any adequate water supply. Water had to be gathered from local rivers or from water pumps located nearby, but the quality of urban water was far from perfect, as water used for drinking also contained various waste materials.

By the late 1830s and early 1840s, British governments at both the local and the national level were forced into finding solutions for the poor environmental and moral conditions in which people lived. The unfolding of such rational approaches to the urban form marked a fundamental change in the comprehension of the association between social and economic growth and the urban environment, a consequence of the development of the understanding that the urban conditions created under the forces of industrialization and urbanization were not conducive to salubrious living for not just many urban dwellers but a large proportion of the populace.

However, despite such knowledge, the wage structure, and so the working classes' ability to compete in the housing market, had to be strangled in the capitalism system in order to underpin national economic prosperity, which was the basic cultural bequest given to Britain by the Industrial Revolution. Slum housing, which was to be found in every town and city in Britain, was therefore an unfortunate though imperative byproduct of culture and its economy at that time.

The dynamics of any proposed Victorian public involvement thus had to improve the plight of the poor—that is, improve the quality of life for people living in the cheapest and worst housing—without encroaching

upon society's cultural machinery for creating and maintaining its wealth, that is, capitalism. This was achieved through intervening in the housing market by introducing rules to improve the quality of new privately built houses. Therefore, as much as environmental improvement was about improving the plight of individuals, it was also about maintaining the capitalist machine that the Industrial Revolution had helped establish. Such a situation has been highlighted, for example, by government reports from the 1840s, which show the thought that unhealthy workers were not able to fully contribute their economic worth to industrial production. A healthy person could work more and better so it was in the nation's economic interest at least to keep people healthy. For an insight into living conditions in England at the start of the 19th century refer to Friedrich Engels's *Condition of the Working Class* in England in 1844.

### CAPITALISM AND MARXISM

The social system produced by the Industrial Revolution can be characterized by a significant number of working people engaging in industrial labor, working in sometimes large-sized industrial units (factories) owned by a single person or a small group of individuals. Philosopher Karl Marx wrote extensively on the development of capitalism and the social tensions it created between the main two social groups that he called the bourgeois, the owners of production, and the proletariat, the industrial workers who were viewed largely as being commodities and not as people by the factory owners.

The relationship between the bourgeois and proletariat, and Marx's views on their association, has been greatly influential on wider social and political thought since Marx and Engels wrote the *Communist Manifesto* in 1848. The ideas of Marx were greatly influential upon political revolutions such as that instigated by the Bolsheviks in early-20th-century RUSSIA and upon governments in countries such as CHINA, CUBA, North KOREA and parts of Eastern Europe in the 20th century. It can be argued that Marx's influence upon the Chinese communists in the 20th century was such that it allowed the Industrial Revolution to occur later in the country than would have happened otherwise.

It has been shown that the Industrial Revolution influenced all aspects of society. Developments in other areas of society also affected the industrialization process. For instance, while brief mention has been given to the significance of technological developments, such as the steam engine, these developments

also assisted industrial growth by other means. If the steam engine is taken as an example, its development also allowed by the start of the 19th century transport developments via the invention of the steam train. The invention of the train not only allowed greater speed of movement around regions and countries, thus assisting the migration of people from one place to another, but it also helped establish a network of communications between places that were previously isolated from each other. Therefore, industrial markets could open up, raw materials could be speedily brought from one area to another, and finished goods taken to the market place at a much quicker speed than before.

With regards to developments in rail, Britain again took a leading role. By as early as 1830 Liverpool and Manchester, two of the largest cities at that time in England, were joined by rail line. At this time the first passenger station in Manchester was opened. Steam engines were also developed by the British in boats, which allowed for quicker travel between Britain and the American continent and the quicker import/export of goods and raw materials. Such developments naturally did not hinder industrial progress.

### SECOND INDUSTRIAL REVOLUTION

Toward the end of the 19th century, developments and societal change, particularly in Germany, have been called a Second Industrial Revolution. Changes within the chemical, steel, petroleum, and electrical industries from the 1870s mark the start of the second industrial transformation, a new phase of industrial and social development.

Whereas Britain was the cradle of the first revolution, Germany was the cradle of the second. Within Germany from the 1870s, much technological and social change occurred. Market prices, for example, were controlled by cartels, investment was plowed into advancing matters of science, and new technologies utilized in the production process.

While the second phase of the Industrial Revolution had the same social problems that were evident during the first period—for example, low wages, poverty, crime, unemployment, and the major element of workers engaging in industrial production—what may be noted as being wholly different about the two phases is their sources of power. While wood and coal were employed as means to generate steam power at the end of the 18th century and start of the 19th century, by the start of the second industrial period (from the 1870s), power was being generated by electrical motors and combustion engines.

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## insurgent state

**INSURGENT STATE** is a term that refers to the creation of a geographic area that not only claims independence from the larger state, but whose leaders and policies also seek to replace the existing political order and state, or to become independent. It is not a segment of the country that seeks independence (civil war). It is a state within a state whose leaders seek total control of the existing state. It is not an **ENCLAVE**, as it is not a base or colony of another external, state or power.

While not a new phenomenon, the conscious use of **GUERRILLA BASES** to form a proto-state is largely the product of Mao Zedong in his war to become ruler of all **CHINA** in the 1920s. Since then, the practice of creating distinct geographic areas that are beyond the control of the central government, and which also seek to replace that government or become wholly separate, has become widespread. The Sendero Luminoso in **PERU**, Che Guevara's *foco* model for **BOLIVIA**, the current creation and recognition of separate political areas in **COLOMBIA**, and the numerous rebel-controlled areas in **Africa**, all provide examples of this process.

It is a case of using geography to change politics (the geography behind politics). It is not the same as creating colonies and thus colonialism. If the base

should seek only regional autonomy or a redress of local grievance, then it is not an insurgent state. It would be a guerrilla base or bandit area.

In the 21st century, the al Qaeda movement created by Osama bin Laden has changed the scale for the creation of a politically focused insurgent state from local to global. This movement seeks to establish insurgent states among conservative Muslims, and then to use these bases (insurgent states) to change regional and perhaps global governments. However, this is not the first such movement to seek a global change using small enclaves. The early Christians and later the Roman Catholic Church have used similar techniques in pursuit of their goals.

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## intercropping

**THE CULTIVATION OF TWO** or more crops in combination in the same field at the same time is known as intercropping. This is one of two types of multiple cropping, the other being sequential cropping, whereby two or more crops are grown in sequence in the same field. There are four types of intercropping:

1) Mixed intercropping is the cultivation of two or more crops that are randomly distributed rather than grown in rows. This practice is typical of slash-and-burn agriculture, which relies on cutting and firing.

2) Row intercropping involves the cultivation of different crops in adjacent rows. This is typical of agricultural systems with intermediate technology such as plows.

3) Strip intercropping utilizes strips of land rather than narrow rows. Each strip is of sufficient magnitude that it can be cultivated independently, but the width does not preclude interaction between the crops, such as the prevention of disease as individual crops act as barriers. This practice is characteristic of commercial large-scale farming, which is mechanized.



4) Relay intercropping involves the planting of a second crop into a first crop that is partway through its growth but is not yet ready for harvesting. It may incorporate elements of some of the above.

Where a tree crop is present, between the rows of which other crops or grass for fodder are grown, the system is referred to as agroforestry, but it is nevertheless a type of intercropping.

There are several advantages to intercropping that relate to socioeconomic factors and environmental factors. In an economic context, farmers practicing intercropping rarely experience total crop failure and so have a safety net provided by the successful crop(s). Farmers and their families may develop self-sufficiency when they cultivate crops for various purposes such as food, fiber, the feeding of animals and medicines. The practice also facilitates the spread of labor because intercropped species are planted, tended, and harvested at different times. Disadvantages are few but harvesting can be difficult if machinery or special skills are required for the different crops.

The ecological/environmental aspects of intercropping reflect the varied requirements of crop plants for nutrients, shade, light, length of growing season and disease resistance/susceptibility, as well as beneficial relationships with soil flora and fauna. It is, however, essential that an appropriate combination of species is selected. Overall, productivity increases per unit area of land in intercropped systems when compared with monocultural systems.

For example, it is advantageous to grow tall and short crop species—maize (corn) with peanuts or a root crop—especially those with different growing times, in alternate rows, as this reduces competition of light. Or two tall crops may be planted provided they have different growth rates so that they mature at different times. Leguminous crops are also important in intercropping systems because of their association with nitrogen-fixing bacteria that occupy root nodules. These fix nitrogen from the atmosphere and convert it into nitrates. Once in the soil, these salts benefit all crops and reduce or eliminate the need for costly artificial fertilizers.

An example of such an association for agriculture in a temperate environment is maize with oats and soybean, of which the latter is the legume. For a tropical environment, peanut is the legume that is intercropped with sorghum and millet.

Combinations of crops with different nutrient requirements are also desirable in order to utilize the nutrient store in the soil sustainably. In this respect, the

crops complement each other and the agricultural system is similar to natural vegetation communities that tend to be diverse with the coexistence of species with complementary environmental requirements. Complementarity replaces competition.

Intercropping generally reduces the outbreak and impact of diseases and pests and so less of the produce is lost in the field. The crop variation appears to favor a wider variety of beneficial insects that prey on pests when compared with monoculture. Rows of crops not preferred by specific insects will act as barriers. Alfalfa, another legume, is especially beneficial in intercropping because it attracts more beneficial insects than most other crops. With careful management, pesticide use can be reduced. The spread of disease, such as fungal and viral pests, can also be limited by such barriers. The maintenance of a crop cover can reduce the incidence of weeds as can the establishment of a good root mat below ground if crops with different root systems are chosen.

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## international date line

THE INTERNATIONAL date line (IDL) is the imaginary line on Earth slicing through the center of the PACIFIC OCEAN that separates two consecutive calendar days. Countries in the Eastern Hemisphere to the left of the line up to the Prime Meridian are always one day ahead of countries to the right of the line and west of the prime meridian. The international date line also marks 180 degrees of longitude. In spite of its name, the IDL has no force in any international treaty, law, or agreement. As a result, there have been numerous changes in the location of the line in the past, and today the line is not straight but jagged, its line in some parts extending as far as the 150 degrees longitude line.

The formation of the line has roots in a problem called the circumnavigator's paradox, in which travelers going westward would find upon returning home

that one more day than they thought had elapsed, and eastward travelers found that they seemed to take one day less than they recorded upon reaching their destination. The first known mention of the circumnavigator's paradox was in the *Taqwin al-Buldan*, written by the Syrian prince-navigator Abu 'l-Fida between 1273 and 1331.

The circumnavigator's paradox was noted by explorers of some famous journeys, including in 1519 during the first circumnavigation of the globe led by Ferdinand Magellan and during Francis Drake's westward circumnavigation of the globe in 1577–80. The problem also fascinated the world of fiction; the idea of gaining time going eastward was crucial for Jules Verne's fictional character Phileas Fogg in the classic *Around the World in Eighty Days*.

The international date line can be placed anywhere on the world, but it is most conveniently located 180 degrees from the prime or zero meridian, found at Greenwich, England. The line is also most convenient passing through only water, as was suggested by one of the early advocates of the new meridian, Erik de Put. It was not until the 1800s that new strides were taken to set a new date line, but even then, authorities were skeptical about the use of such a line, especially since countries for a long time could not even agree on a common prime meridian.

The international date line has not been static over time, its shift in time and place owing to local interests and political affiliations. One notable shift was the Philippine adjustment, where prior to the present position, the Philippine Islands had been to the east of the line. This was because Spanish travelers used to journey to the then-Spanish colony via South America, so it was convenient for them not to have to adjust their dates when they reached the PHILIPPINES. During the early 1840s the commercial interests of the Philippine Islands turned increasingly away from South America (which had become independent from SPAIN) and toward trade with the nearby Malay Peninsula, the Dutch East Indies, AUSTRALIA, and CHINA. In 1844, in order to facilitate the growth of these new trading and communication links, the American day reckoning was abolished in favor of the Asian day reckoning.

Other significant changes include ALASKA, which was to the west of the International Date Line when Alaska belonged to RUSSIA, because most travelers arrived there by way of SIBERIA. When the UNITED STATES bought Alaska in 1867 the line was moved to the west of it. The most recent change was in 1995, when KIRIBATI was moved to the east of the line so that the entire

nation would be on the same side of the line and the same day.

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## Intifada

INTIFADA IS THE name given to the popular uprising of the Palestinian population against the continuation of Israeli occupation of the West Bank and Gaza Strip. There have been two Intifadas, the first, essentially spontaneous and indigenous, began in December 1987 and continued sporadically until the early 1990s. The second Intifada began after the collapse of the Camp David peace talks in September 2000. The Intifada was then under the control of various political parties and the Palestinian Authority and was a conscious military tactic, using the name of a popular precursor.

Many political commentators have attributed the holding of the Madrid peace talks in 2001 and the signing of the Oslo Accords in 1993 as resulting, in part, from the events of the first Intifada and the realization that a democratic Israel, even with the strongest military force in the region, could not continue to control a civilian population of 3 million people against their wishes and their demand for sovereignty and independence.

The first Intifada broke out at the end of 1987 initially in the Gaza Strip. It soon spread to all of the occupied territories. It was the first time in 20 years of Israeli occupation that a geographically coordinated mass civilian uprising against Israeli occupation and the occupation military authorities had taken place. It was characterized by widespread acts of civil disobedience and the use of nonlethal weapons. The throwing of stones and the burning of tires and blocking of roads, followed by Israeli military retaliations and the imposition of curfews on Palestinian villages, became an almost common occurrence during this period. The actions united and coordinated once separate and distinct villages and people. It was an organization prima-

rily of youth and not controlled by the Palestine Liberation Organization or Yassir Arafat. For the first time, it became unsafe for Israelis to travel throughout the West Bank. Former places of Israeli-Palestinian interaction, such as the weekend markets in the Palestinian town of Kalkliyah and the commercial nodes of East Jerusalem, ceased to function as a result of the fear on the part of Israelis.

The second Intifada broke out following the breakdown of the Camp David Peace Talks in 2000. Each side blamed the other for the failure to reach a final peace agreement. The frustration among the Palestinian population, who had expected, finally, to achieve their independence, became evident through renewed acts of violence against Israel and the Israeli military authorities. Unlike the first Intifada, the second Intifada was not spontaneous. It also was characterized by a shift to the use of lethal weapons, many of which had been accumulated during the 1990s.

As a result of the Oslo Accords, the Palestinians had achieved limited autonomy in parts of the West Bank and Gaza Strip. The influence and direct intervention of the more radical political organization, the Hamas (which was in its infancy during the period of the first Intifada) also resulted in the introduction of suicide bombers in Israeli civilian centers causing significant carnage and death inside Israel itself. The conflict was now carried outside the occupied territories and into once safe districts of Israel itself.

The demand by Israelis for greater security resulted in the election of a hard-line right-wing government under the leadership of Prime Minister Ariel Sharon, who in turn proceeded to use the full might of the Israeli army to retaliate against the Palestinian population, in some cases almost totally destroying the civilian infrastructure that had been established during the post-Oslo period.

The Israeli government argued that it was the responsibility of the Palestinian Authority, under the leadership of Chairman Arafat, to reign in the violence, despite the fact that he had gradually lost control of the more radical elements within the Palestinian population, and especially throughout the Gaza Strip which had become the headquarters of the Hamas movement.

The Israeli government also targeted leading Hamas leaders, most notably Sheikh Ahmed Yassin, for assassination (in 2004) while claiming that they could no longer do business with Arafat and that, in the absence of an alternative Palestinian leader, there was no "partner" for political negotiations. This position was backed up by the George W. Bush administra-

tion, bringing about the almost total isolation of Arafat and the suspension of any peace talks between the two sides. With Arafat's death in 2004, newly elected Palestinian leaders brought a fresh approach to negotiations.

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## Iowa

IOWA IS A midwestern state in the north-central part of the UNITED STATES bordered on two sides by major rivers. To the east is the MISSISSIPPI that separates Iowa from ILLINOIS and WISCONSIN. In the west, the Missouri River separates it from NEBRASKA, while the Big Sioux River separates it from SOUTH DAKOTA from Sioux City northward. To the north lies MINNESOTA and to the south MISSOURI.

Interestingly, there is a small heel of Iowa that extends south into Missouri in the southeastern corner of the state along the MISSISSIPPI RIVER. Here, Iowa actually has a western boundary with Missouri, since you can leave the city of Keokuk and drive westward into Missouri.

The state's rich, fertile plains are generally low and gently sloping for the eastern three-quarters of the state. Rivers in the area, including the Des Moines River, which flows from Minnesota through the middle of the state, all flow in a southeasterly direction toward the Mississippi River. There is a small region in the extreme northeastern corner that was not glaciated during the last ice age that Iowans often refer to as the Switzerland of Iowa because of the visual effect the sharp cuts in the river bluffs along the Mississippi River give to the landscape.

The western one-quarter of the state is somewhat higher in elevation, with numerous rivers dissecting the hill country along the western border as they flow in a

southwesterly direction toward the Missouri River. Elevations in the state range for a low of 380 ft (116 m) above sea level in the boot heel region in the very southeastern corner to 1,670 ft (509 m) at Hawkeye Point in the northwestern corner of the state. Slightly more than 100 years ago, you would find extensive woodlands of hickory and black walnut in the state as well as extensive prairies with grass higher than the wagon wheels of the settlers' wagons. But rapid settlement during the 19th century brought on rapid deforestation and the plow turned nearly all of the prairie grasslands into farmland for corn and other grains.

Des Moines (pronounced without the "s" sound in either word) is the capital and largest city, with 198,682 residents (2000). Other important cities near or above the 100,000 mark are Cedar Rapids (120,758) and Davenport (98,359). Iowa ranks 30th in total population, with 2,926,324 residents, and 26th in land area at 56,276 square mi (145,756 square km). The state's 10 largest cities account for 29 percent of the total population, enough to drop the density feeling as you drive around the state to 36 persons per square mi (94 per square km) from the official figure of 52.37 per square mi (136 per square km). Iowa ranks 33rd in per capita income (\$26,431) and 35th in disposable per capita income (\$22,949).

### EARLY SETTLERS

Prior to the first Europeans coming to Iowa, the area was home to prehistoric Native Americans mound builders who were primarily farmers. By the time the Europeans arrived in the 17th century, the Iowa, Sac, and Fox roamed over the land, in addition to the Sioux who dominated the area. Fur traders found the land profitable during the late 1600s, establishing a number of small towns along the Mississippi River and Des Moines River junction.

By the late 1700s, the area near present-day Dubuque was leased from the Indians for lead mining. Iowa came into the control of the UNITED STATES in 1803 following the LOUISIANA PURCHASE. Until 1821, Iowa was part of the Missouri Territory. After 1821, Iowa was part of both the Michigan Territory and Wisconsin Territory prior to being organized as the Iowa Territory in 1838. With a reputation for rich soil, Iowa grew rapidly as new immigrants flocked to the state. Many of these came from Europe, notably Germans, Czechs, Dutch, and Scandinavians, bringing their agricultural skills and own customs to enrich Iowa's rural life. One group of German Pietists established the Amana Church Society, a successful attempt at com-

munal organization still recognizable as the Amana Colonies. Iowa became a state in 1846 and in 1857 the capital was moved from Iowa City to Des Moines.

Iowa truly is a breadbasket for the United States with 90 percent of the land devoted to farming. The deep, porous soils help sustain yields in corn and other grains in tremendous quantities. Iowa often leads the nation in the production of corn, soybeans, hogs, and pigs, and is ranked in the top 10 in the raising of cattle. Iowa corn-fed hogs and cattle are nationally known. And Iowa consistently ranks high among farm states in terms of farm income. Abundant and consistent agriculture yields have also benefited the state's food processing industry. Non-electrical machinery, farm machinery, tires, appliances, electronic equipment, and chemicals are among the other manufactured products. Mineral production is small and centered around cement (the most important mineral product) stone, sand, gravel, gypsum, and some coal. Communications, finance, and insurance are especially important in Des Moines; the area is often referred to as the Hartford (from Hartford, CONNECTICUT, insurance companies) of the Midwest.

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## Iran

**Map Page** 1122 **Area** 636,296 square mi (1,648,000 square km) **Population** 68,278,826 **Capital** Tehran **Highest Point** 18,605 ft (5,671 m) **Lowest Point** -91 ft (-28 m) **GDP per capita** \$6,800 (2002) **Primary Natural Resources** petroleum, natural gas, coal.



IRAN IS A MIDDLE EASTERN country, bordering the Gulf of Oman, the PERSIAN GULF, and the CASPIAN



SEA, between IRAQ and PAKISTAN. Iran is a large country that is dominated by rugged mountains and large deserts. At its center is the Iranian Plateau, with great mountain ranges such as the ZAGROS in the west, the ELBURZ in the north along the Caspian Sea coast, and the mountains of Khurasan to the northeast. These mountains and the high plateau create a bowl-shaped arid expanse broken by oases that mark the ancient caravan routes. Along the Caspian coast in the north a subtropical climate exists, supporting the primary fertile region of Iran.

The Iran of today stands upon an ancient base of civilization and culture. Long a crossroads for conquerors, it has been known in the West as Persia since the beginnings of historical records associated with Cyrus the Great in the 6th century B.C.E. Alexander the Great brought Hellenistic culture to Persia in the 4th century B.C.E. and opened the gate to a long procession of foreign dynasties that would rule there. Greeks, Turks, Arab-Muslims, Mongols, and Tamerlane all made their mark as centuries passed. It was during the Safayid dynasty (1502–1736) that one of the great Persian empires arose. Under Shah Abbas, the Shia branch of Islam was made predominant and the holy city of Esfahan was rebuilt as the capital.

Invasion, succession of dynasties, and finally a nationalist uprising brought Iran into the 20th century. In 1925, a final dynasty was created by an army officer who had seized power and proclaimed himself shah, creating a new Pahlavi dynasty. Under Shah Reza Khan, Iran began to modernize and consolidate power as a nation-state. In 1941, during occupation of western Iran by UNITED KINGDOM and Soviet Union forces, the shah was forced to abdicate and his son Mohammad Reza Pahlavi became the new shah. At the end of World War II, allied forces were slow to withdraw, but with pressure from the UNITED STATES, Soviet forces left and the young shah reestablished his power over all Iran. He became closely aligned with the West. His pro-modernization and pro-Western stance did not hold well with the people of Iran.

Over his three decades of rule, repression and economic difficulties were the norm. The shah fled the country and an exiled religious leader, Ayatollah Ruhollah Khomeini, returned to witness a popular Islamic revolution sweep the country. The United States had long supported the now-shunned Shah Pahlavi and was associated with the feared and hated secret police, the SAVAK. In 1979, the U.S. embassy in Tehran was seized and the embassy personnel were held hostage for over a year.

Conservative clerical forces established a theocratic government within an Islamic republic. Soon after Ayatollah Khomeini's return and rise as Iran's religious leader, neighboring Iraq invaded Iran along its western border and started a bloody eight years of warfare. The West no longer supported the government of Iran and backed Iraq with arms sales and military intelligence during the deadly and futile conflict that raged until 1988.

Relationships with the West remain difficult today as questions of Iran-sponsored terrorism and assassinations are topics of official communications. The United States maintains a trade embargo against Iran. Calls for United Nations scrutiny of Iranian atomic energy programs have increased in light of concerns with proliferation of nuclear weapons technology and pursuit of weapons of mass destruction.

The Persian language, also known as Farsi, is spoken by over half of the population and is written with Arabic script. Turkic dialects make up the next largest language group. The peoples of Persia have long been known for their artistic excellence in handcrafts, architecture, and poetry. Iran has a rich ethnic mix across its landscape. Whereas more than 60 percent of the population is of Aryan origin, large groups of Turkic, Persians, Kurds, Lurs, and Baluchi are found as well. Nearly two-thirds of the population now resides in urban areas where some modernity has taken hold, but the remainder lives in a vast land close to the rhythms of rural life.

Iran's constitution now proclaims that Shia Islam is the official religion. Some 89 percent of the Islamic population of Iran belongs to the Shia branch of ISLAM. The Sunni branch has historically controlled leadership in neighboring Muslim countries. Clerics now dominate politics and almost all aspects of urban and rural life in Iran. Iran is most closely associated with strict Islamic beliefs yet is also the birthplace of the ancient Zoroastrian faith and the more recent Baha'i religion.

Iran's economy is based upon oil production, with over 80 percent of all revenues stemming from this industry. The nation's overall economy requires more diversification and modernization. Iran's economy is a mixture of central planning, state ownership of oil and large scale enterprises, village agriculture, and small-scale private trading and service ventures. Economic reforms continue but at a measured pace and with mixed results.

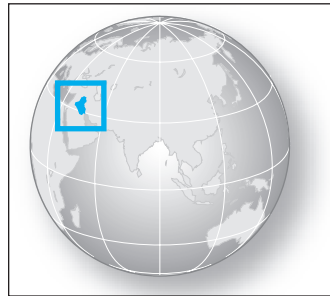
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## Iraq

**Map Page** 1122 **Area** 168,754 square mi (437,072 square km) **Population** 24,683,313 **Capital** Baghdad **Highest Point** 11,847 ft (3,611 m) **Lowest Point** 0 m **GDP per capita** \$2,400 **Primary Natural Resources** petroleum, natural gas, phosphates.



IRAQ IS A MIDDLE EASTERN country, bordering the PERSIAN GULF, between IRAN and KUWAIT. Iraq is also bordered by TURKEY, SYRIA, JORDAN, and SAUDI ARABIA. The country contains most of the large flat basin created by the Tigris and Euphrates rivers. Both great rivers have their origin in high mountains outside of Iraq. The expansive landscape slopes down from these heights descending gradually to the Persian Gulf in the southeast.

Here, the two rivers have created a large DELTA that forms the Shatt al-Arab shared with Iran. To the south, the broad plains mingle with the vast deserts of Saudi Arabia. The mountainous region of northern Iraq receives appreciably more precipitation than the central or southern desert regions, yet extensive irrigation makes much of the country arable along the two great rivers.

From ancient times, the area of Iraq has been known as Mesopotamia. One of the great hearths of human civilization, the Tigris-Euphrates river complex has supported many kingdoms, empires, and dynasties. Sumerian, Babylonian, and Parthian cultures emerged and flourished before the faith of ISLAM made its way to Iraq in the 7th century C.E. A great Islamic empire, the Abassid caliphate, established its capital at Baghdad, which, in turn, eventually became an outpost of

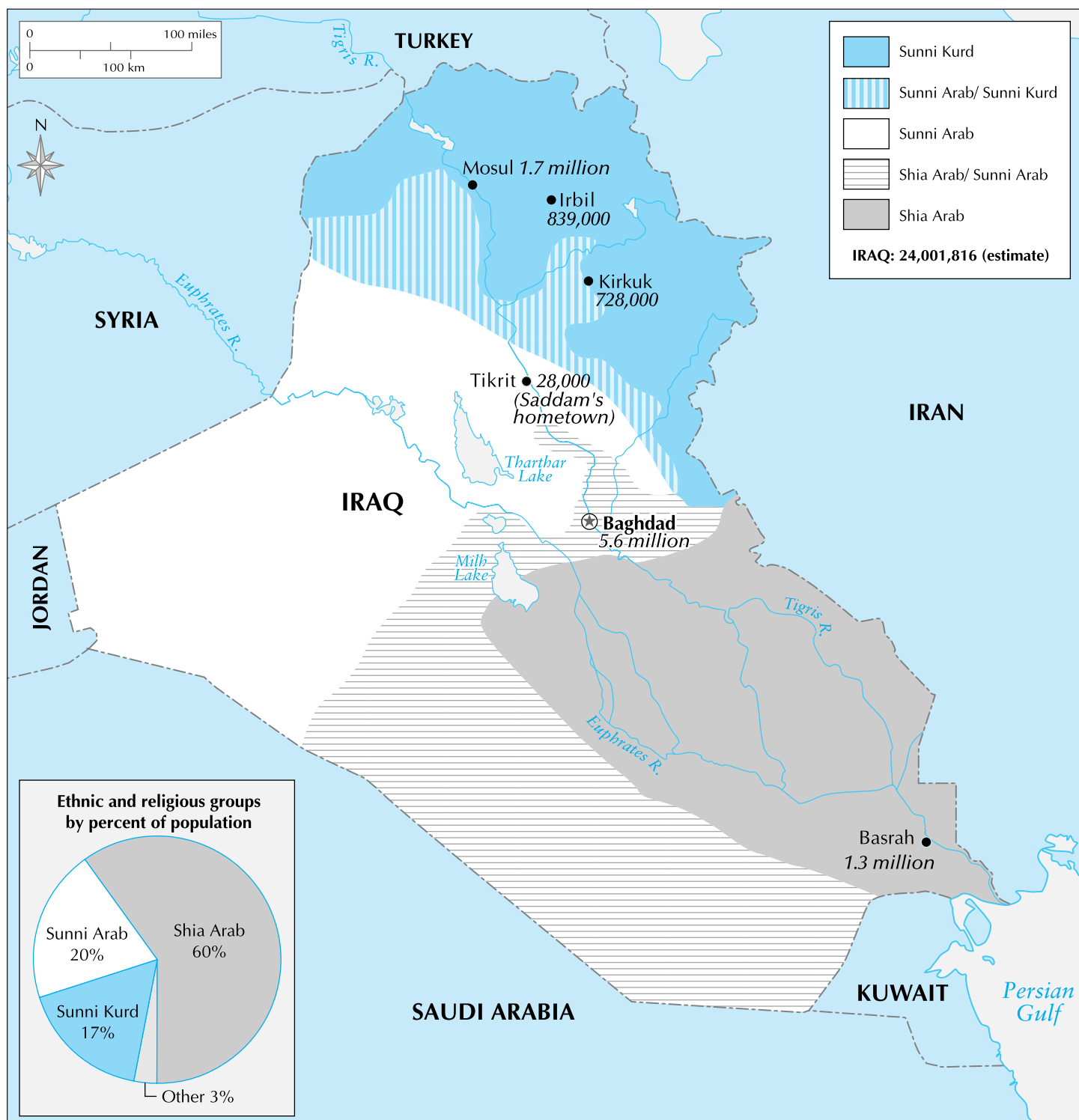
the OTTOMAN EMPIRE. Centuries of commercial trade and cultural exchange continued in a stark land as the fortunes of the great Turkic empire of the Ottomans and other Islamic dynasties, such as the Safavids, rose and fell. As the Ottoman Empire expired at the end of World War I, Iraq was occupied by the British and in 1920 became a British-mandated territory under the auspice of the League of Nations. When declared independent in 1932, the Hashemite family, which also ruled Jordan, ruled as a constitutional monarchy.

A republic was proclaimed in 1958, with the killing of the monarch and establishment of power by a military strongman. Continuing political assassinations and overthrows eventually brought the Arab Socialist Renaissance Party (Ba'ath Party) to power in 1963. In 1979, a protégé of the party, Saddam Hussein, was selected by the outgoing ruler and began his role as supreme leader.

Acting in the bellicose style of his predecessors, Hussein used territorial disputes with Iran as cause to launch a bloody and inconclusive war that lasted for eight years (1980–88). The West supported Iraq by sale of arms and provision of military intelligence. This war saw the first large-scale use of chemical weapons since the battlefields of Europe in World War I. The use of these weapons was to haunt Hussein's regime. Facing tremendous debt, degraded commercial access to the gulf, and dismal return on vast military expenditures, Saddam used similar logic and bluster when in August 1990 Iraq invaded and annexed Kuwait. The threat to the free flow of oil to the industrialized West and Asia galvanized a United Nations (UN) coalition, launching a U.S.-led attack that freed Kuwait in 1991 and destroyed much of Iraq's military capability. The UN Security Council required Iraq to end all production and procurement programs related to weapons of mass destruction and long-range missiles. This was to be verified by UN inspectors, but because of noncompliance by Iraq, a decade of sanctions, embargoes, and military actions ensued.

In March 2003, the UNITED STATES led an invasion of Iraq and the overthrow of the Hussein regime. The occupying U.S.-led coalition and recognized Iraqi leaders established advisory and governing councils on the local, regional and national level to ensure that the path into the political future results in elections to establish an internationally recognized representative government in Iraq.

Most of Iraq's population lives on the ALLUVIAL PLAIN stretching from the mountains of the north toward the Persian Gulf off to the southeast. The Tigris



*The Arabs of Iraq are predominantly followers of the Shia sect of Islam, but have long been oppressed by political leaders holding to the Sunni sect. The U.S.-sponsored elections of 2005 reflected the Shia majority population base.*

and Euphrates rivers continue to be the focus of human settlement as they have been since ancient times. The ruins of great cities of history such as Ur and Babylon

share this landscape with the biblical location of the Garden of Eden. Over three-quarters of the Iraqi population is Arab, but the Kurds make up a significant

ethnic minority. The Kurds are most closely associated with the mountainous regions and hold to the Sunni sect of Islam. The Kurds of Iraq have long shared the misfortunes of a stateless nation along with their kinsman in Turkey, Iran, and Syria. The Kurds remain culturally distinct in language, customs, and politics.

### MARSH ARABS

The majority of Arabs in Iraq are followers of the Shia sect of Islam but have long been oppressed by political leaders holding to the Sunni sect. One of the more notable incidents of this was the systematic effort to destroy the Marsh Arab culture found in the southern marshes near of the mouth of the Euphrates River. These Shia communities had long thrived in the reedy marshlands that comprised a natural food-producing region. A Ba'ath regime policy to drain the marshes was implemented to control insurgent movement in the area and introduce irrigation agriculture. This massive drainage project resulted in an ecological and cultural disaster, as salinization of the soil spread and traditional communities were displaced.

The petroleum sector has dominated the economy of Iraqi even before nationalization of its oil industry in the 1970s. The disastrous war with Iran followed by the ill-conceived invasion of Kuwait left Iraq with hundreds of billions of dollars of international debt, economic losses, and war reparations. Further economic sanctions by the UN related to disarmament removed the country from any meaningful role in the world economy.

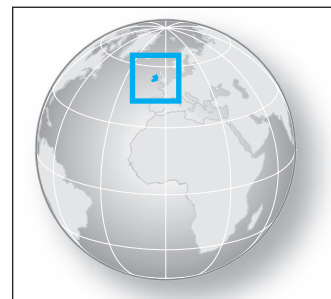
However, with the world's third-largest proven oil reserve and promising unexplored oil-bearing regions, Iraqi oil stands to create significant revenue for some time to come. After the U.S.-led invasion, the UN Security Council lifted all sanctions against Iraq and passed resolutions to ensure that Iraq's oil export earnings are immune from legal proceedings, such as debt collection, until the end of 2007.

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## Ireland

**Map Page** 1131 **Area** 27,135 square mi (70,280 square km) **Population** 3,924,140 **Capital** Dublin **Highest Point** 3,414 ft (1,041 m) **Lowest Point** 0 m **GDP per capita** \$30,500 **Primary Natural Resources** zinc, lead, natural gas, barite, copper, gypsum.



THE REPUBLIC OF Ireland covers five-sixths of the island of Ireland and shares its only border with Northern Ireland, which is part of the UNITED KINGDOM of Great Britain and Northern Ireland, also known by the historic name of Ulster. Ireland is a republic with a president as head of state and a prime minister as the head of government. Its legislative branch is a bicameral parliament. Ireland is divided into four provinces and 26 counties. English is widely used throughout Ireland, but Gaelic is also spoken along the western coast. Ireland's major cities are Dublin, Cork, Limerick, Waterford, Galway, Dundalk, and Kilkenny.

Ireland's terrain is mostly level to rolling interior plain with rugged hills and low mountains. The west coast is studded with sea cliffs, while the east coast of Ireland has few indentations. The central part of Ireland consists of bogs, meadows, and lakes. The chief rivers in Ireland are the Shannon, Boyne, and Blackwater. The temperature ranges from 40 degrees F (4 degrees C) in the winter to 62 degrees F (16 degrees C) in the summer. Ireland receives an average rainfall of 40 in (102 cm) per year.

Human settlement in Ireland goes back more than 10,000 years during the Mesolithic period. Ireland experienced waves of migrations in its early history. The Gaels, who are the ancestors of the modern Irish people, first settled in Ireland in 700 B.C.E. Christianity arrived in Ireland around the third century, although it was through St. Patrick's missionary efforts between 432 and 465 that it took root, making Ireland a center of Christianity in early medieval Europe.

England began its control of Ireland in the 12th century when Dermott MacMurrough of Leinster sought the assistance of Henry II of England in his battles against other Irish chieftains. The conquest of Ireland was complete in 1541 when Henry VIII was declared king of Ireland by the Irish Parliament following a rebellion. Under the Tudors, England began the "plantations," which was systematically settling parts



of Ireland with English settlers. Ireland was also pulled into the English Civil War and suffered under the resulting rule under Oliver Cromwell in the 17th century.

During the Restoration in 1660 under Charles II, the Irish Catholics were relieved of the persecutions imposed upon them. With the succession of James II in 1685, they were hopeful of having a Catholic on the throne again. Even though James II was deposed during the Glorious Revolution of 1689, Irish Catholics continued to recognize him as their king. In 1690, the forces of King William defeated the forces of James II in the Battle of the Boyne, resulting in the Penal Laws, which not only marginalized Irish Catholics from the political and economic life but also witnessed the rise of an Anglo-Irish elite. Economic conditions under absentee landlords led to the Rebellion of 1798.

Through the Act of Union in 1801, Ireland became part of the United Kingdom of Great Britain and Ireland. By 1829, Irish Catholics benefited from the Catholic Emancipation Act. Between 1845 and 1851 the Great Famine ravaged throughout Ireland, which reduced its population from 8 million in 1845 to 2 million in 1851 due to starvation and emigration. The famine exposed the flaws in the Irish tenure system and British governance. The latter half of the nineteenth century was consumed by the question of home rule for Ireland. Home rule remained an intractable question because Ireland was divided between the Irish Catholics who supported an independent parliament and internal autonomy and Protestants in Ulster who wished to remain loyal to Westminster.

In 1920, after the cataclysm of World War I and a guerrilla war against the British army, the Government of Ireland Act divided Ireland into twenty-six southern counties that were represented by its own parliament in Dublin, and the six counties in Ulster that continued to be represented in Westminster. The Anglo-Irish treaty retained allegiance to the British sovereign and naval bases on the Irish coast. In 1937, the Irish Free State became Eire, which repudiated the Anglo-Irish Treaty of 1921.

During World War II, Eire declared its neutrality, depriving Britain use of naval bases in the southern coast. In 1948, the Republic of Ireland Act severed all ties to Britain, the Empire, and the Commonwealth, while Northern Ireland remained loyal to the Crown. In turn the British parliament passed the Ireland Act, which gave rights to all citizens of the Republic of Ireland who traveled to Britain. With the outbreak of violence in Northern Ireland in 1972, the Republic of Ireland and Britain have since cooperated against the

Irish Republican Army and other terrorist groups. In 1973, the Republic of Ireland joined the European Economic Community. In 1998, the Republic of Ireland has been a participant in the Good Friday Agreement, in the resolution of "The Troubles" in Northern Ireland, though efforts have stalled in recent years. In 1999, Ireland adopted the euro as its currency. In 2001, a majority of Irish citizens vetoed the Treaty of Nice because of doubts on the expansion of the EUROPEAN UNION (EU). In 2004, the Republic of Ireland assumed the presidency of the EU, tackling issues such as drafting a new constitution for Europe.

Ireland has had a rapidly growing economy in recent decades, growing at an annual rate of 8 percent between 1995 and 2002. Industry makes up for 38 percent of the GDP, while services account for 49 percent of the gross domestic product. Much of its economic growth was due to its exports in technology, followed by consumer spending, construction, and business investment. Ireland's chief trading partners are Britain, the UNITED STATES, GERMANY, FRANCE, JAPAN, and the NETHERLANDS.

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## Irrawaddy River

THE IRRAWADDY is the chief river of MYANMAR, or Burma. It is formed from the confluence of the Mali and N'mai rivers far in the northern highlands on the borders with CHINA, and flows 1,350 mi (2,177 km) before entering the Andaman Sea (a section of the BAY OF BENGAL). The river's extensive DELTA begins about 140 mi (225 km) before it reaches the sea, and splits into nine main channels. It is estimated that the waters of the delta lay down 260 million tons (236 million metric tons) of silt per year.

The capital city of Yangon (Rangoon) is located on one of these delta channels, though not the main river course, located about 70 km (43 mi) to the west. About

a dozen large sea inlets form the mouths of the Irrawaddy, spanning roughly 300 km (180 mi) from west to east. The delta is protected by levees for hundreds of kilometers and is one of the chief rice-exporting areas of Southeast Asia, formerly awarding the area the nickname, the “rice bowl of Southeast Asia.” Steamers can transport goods upstream as far as Bhamo (about 1,000 mi or 1,600 km), nearly to the borders with CHINA’s Yunnan Province. The country’s major oil pipeline follows the course of the river from oilfields near Chauk down to export facilities at Yangon.

The river valley dominates the shape of Myanmar, particularly the central historic province of Burma proper, hemmed in by the parallel chains of north to south mountains, called the Pegu Yoma and Shan Highlands in the east, and the Arakan Yoma and Chin Hills in the west.

The country’s other main river, the Salween, also travels through the same sort of north-south valley, though much narrower (and actually for a much greater distance, originating far inside the Chinese border). A third river, the Sittang, while much shorter, is more comparable to the Irrawaddy in its importance as a chief rice-growing area. Most of the Burmese population lives along these valleys, both in the north, around the city of Mandalay, and in the southern delta.

The river, officially spelled Ayeyarwady, can be divided into two main sections, above and below Mandalay. Above this point it is swift and narrow, with several rocky defiles. But just below Mandalay the Irrawaddy joins with its chief confluent, the Chindwin River, and it becomes broad and slow-moving, ranging from 1 to 4 mi (1.5 to 6.5 km) wide. During seasonal floods, however, the currents can be much quicker and hazardous to river traffic. Forests along the river have virtually been eliminated and continue to be cut down at a rate of approximately 2 million acres (800,000 hectares) a year. The Mon River is also a major tributary, with one of the earliest (and largest) dams in the region, built in 1906 and recently renovated, providing extensive irrigation to the upper reaches of the country’s western regions.

As the commercial center of the British colony of Burma, the Irrawaddy River valley attracted numerous commercial wet-rice planters from the 1850s, funded by money lenders from Calcutta (KOLKATA), INDIA, a source of later friction between independent India and Burma. From 1855 to 1930, the area cultivated for rice increased from 988,000 acres (400,000 hectares) to 9.8 million acres (4 million hectares), and the population

increased from 1.5 million to 8 million. Production dwindled during decades of socialist rule but is starting to pick up again under programs of economic liberalization and remains the regime’s most important source of foreign revenue.

Today, the river is seen as a unifier of the nation’s diverse ethnic groups who populate its banks—including the Kachin, Shan, and Chin minorities—whose independent spirits frequently threaten to pull the state apart.

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## irrigation

IRRIGATION IS THE application of water to crops in addition to what normal local precipitation supplies. It is primarily used in areas with less than 20 in (51 cm) of rain per year (semiarid or arid climates) or in areas of monsoon rains with long dry periods. Irrigation allows growth of nondryland crops in semi-arid regions or can extend the potential cropping season to allow multiple crops. It is also used in some wealthier areas (for example, CALIFORNIA, MISSOURI, and ALABAMA) to take advantage of special crop subsidies and grow water intensive crops like rice or cotton.

Irrigation has been used for thousands of years. Some of the earliest hydraulic civilizations were the FERTILE CRESCENT societies spanning from EGYPT’S NILE to Mesopotamia’s Tigris and Euphrates. Other ancient irrigation cultures have been found in PAKISTAN, CHINA, INDIA, the Andean regions of South America, MEXICO, and the southwestern UNITED STATES.

Various methods of diverting and delivering water produced different levels of efficiency. The first irrigation schemes used simple diversions off of a river to flood entire fields. This method was the easiest to implement but wasted the most water. More specific application diverted water and then let gravity move water toward multiple ditches dug alongside crops. Simple yet ingenious devices were developed to raise river water up on to higher ground. For example, Egyptians first used the shaduf, which was a series of

buckets on counterweighted poles arranged at various levels on the riverbank, to lift water to the level above. Later, they used the Archimedes's screw, which was a large carved screw fitted into a hollow log. Draft animals turned large gears that turned the screw, catching and lifting water through the log to the higher land. Later, treadle pumps were devised in many poorer areas of the world so humans could power the pumps with their feet rather than use fossil fuels.

Sometimes irrigation water was transported many miles to where it was needed. In Pakistan, *qanats* were deep tunnels dug from the distant mountains down to where villages needed water. *Qanats* moved water by gravity and protected the water from evaporation since the water moved underground. Shafts emerging at intervals at the surface allowed the workers to enter the *qanats* for maintenance.

Irrigation generally required the combined effort of many farmers, so a variety of organizations and water laws were created to provide rules for individual use. The *acequias* of NEW MEXICO are an example of old Spanish water organizations created to maintain and oversee the distribution of irrigation water and maintenance of the waterworks. In the early 1900s, the United States created the Bureau of Reclamation to build massive dam projects and manage the diversion of water in the dry West to numerous irrigation districts.

The green revolution of the mid-20th century combined new seed, fertilizers, fossil fuel energy, and irrigation to significantly expand crop output worldwide. Although this was a boon for the rapidly climbing global population, the use of irrigation seems to have only delayed a reckoning between an ever-increasing human population versus a finite supply of fresh water.

Irrigation has continued to expand, and while it helps to produce higher yields, it has significant drawbacks that are becoming more obvious each year. First, irrigation changes the hydrologic regime of a region by reducing the historic flow of streams, dewatering some stream stretches or reducing recharge to connected groundwater supplies. Surface habitat is then degraded along these stream segments.

The ARAL SEA is a good example of a large, once productive sea that is now polluted and shrunk to one-third of its original size because of upstream diversion of water to irrigate cotton. Stranded fishing boats now sit in the sand far outside the current shoreline, and the local economies and human health have never recovered. Many great rivers of the world have also lost so much water to upstream diversions that they rarely

reach the sea anymore. The Yellow (HUANG) River in CHINA, and the Colorado River and the RIO GRANDE in the United States, are just a few examples of this.

Groundwater tables have also dropped through over-pumping aquifers with fossil-fueled pumps. Some known examples of pumping these fossil aquifers are the Ogallala in America's high plains, the Libyan desert, YEMEN, and SAUDI ARABIA. Some farm communities over the Ogallala have already disappeared once local irrigators ran out of water. Sanaa, the capital of Yemen has scant years before running out of its water supply.

In areas where diverted water is delivered, groundwater levels can rise and move salts up into the root zones of crops, killing the crops and permanently ruining the soil. This is commonplace in arid areas, where thousands of hectares worldwide have become sterile and been abandoned because of soil salinization. Besides soil degradation, agricultural runoff carries pesticides, fertilizers and salts back into the stream or groundwater, degrading downstream habitat and poisoning groundwater needed for drinking water.

Modern irrigation is also energy-intensive. When fossil fuels were more abundant, it made sense to use them to access as much water as possible. Relatively cheap oil and pumps helped proliferate irrigation around the globe and helped to speed the unsustainable rates of irrigation common today. Now in the face of increasingly limited supplies and even more global demand, the cost of pumping water will become a far more significant portion of the overall costs of irrigation and add to the cost of food production.

Since the beginning of the 20th century, large dam projects have been built by wealthier countries to supply regions with irrigation water as well as flood control, municipal water supply, and hydroelectricity. More dams are now being built in developing countries, with the World Bank and other lending institutions helping to finance construction. Because 90 percent of the world's children between now and 2050 will be born in the developing countries, the need for irrigation water to grow additional food is obvious.

However, these dam projects are not without numerous costs, and their benefits do not flow equally to the inhabitants of the region the project is in. First, the location of the dam project inevitably displaces many villages, with little or no attention or assistance to help relocate those people. Impounding water spreads a variety of waterborne diseases in poor regions with little or no access to medicine or doctors. Aquatic habitats are drastically changed upstream and downstream of

the dams, reducing the types and quantity of fish that were there before. Nutrients in the sediment that once flowed downstream during flood events is now caught behind the dam, leaving downstream valleys in need of alternative fertilizers. Impounding the water also changes the speed and temperature of the water upstream and downstream, again altering aquatic habitat and reducing fish species. Once the dam is filled and irrigation water is delivered, it does not tend to be delivered efficiently, effectively, or equitably. Consequently, vast amounts of money can be spent on irrigation projects that ultimately benefit only a few people relative to the needs of a region.

Almost 90 percent of water consumed by humans is used for irrigation, and demand for water for all uses is increasing as human population increases and as consumption increases in parts of the developing world. Consequently, competition for water is rising everywhere. Irrigation water is applied to over 40 percent of the world's crops, so any gains in efficiency in this sector would supply additional water for other competing uses.

Modern irrigation practices have increased efficiency by using drip hoses laid at the base of plants or have installed low-hanging sprinklers from center pivot systems to apply the water directly to the plants rather than spraying it up in the air and losing more of it to evaporation.

A rising trend in developing countries is to use sewage effluent for irrigation water. Ten percent of the world's irrigated crops are now irrigated with sewage effluent, which is either partially treated or not treated at all. Despite the health threat to farmers and consumers from using sewage effluent, farmers continue to use it since it is more reliable than local rains and so guarantees them a more reliable income. Farmers will often sell this produce at distant markets so no one will know its provenance or the pathogens it may contain.

Irrigation had fed the world's people for millennia but must keep adapting, refining, and reinventing itself to continue as a solution for agricultural production.

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## Islam

**MOST RELIGIONS**, such as Confucianism, Buddhism, Jainism, and Judaism have a geographic point or place of origin and remain largely focused upon that nexus. Some, such as Christianity and Islam, have engaged in specific efforts to proselytize and spread their faith, often as an integral part of trade. Among the significant geographic impacts of Islam are its often highly parochial nature and obsessive control and defense from foreigners and nonbelievers of its holy cities of Mecca and Medina. Islam spread its political, economic, and cultural dominance over North Africa and Spain, and eventually much of East Africa.

This geographic impact shifted trade routes, and thus culture and political and economic importance, away from the once dominant cities of the eastern Mediterranean (such as Ephesus, Antalya, Sidon and Tyre) to the coasts of Arabia, Mesopotamia (modern Iraq), and Central Asia for control of the silk and spice trade. This meant an almost immediate decline in once prosperous cities and a growing demand by Europeans to regain some kind of control or participation in the lucrative trade. One result was the Crusades, in the end more an economic event than a religious one.

Islam's behavioral requirements and origins in the deserts and barren mountains (Al Hijaz) of Arabia make it ideally suited to tribal societies, individuals, and environments where people are dependent upon themselves, the vagaries of nature, and a supernatural being. With its prohibition of usury (interest on loans) and the highly limited agricultural opportunities (including nomadism) in the lands of its origin, the followers of Islam were virtually forced to emphasize trade and the control of richer agricultural lands.

Thus, the geographic dispersal of Islam, from its origins and core in the Mecca and Medina area, clearly followed Arab trade routes, not those of the Greeks and Romans. It was only after Islam had control of the silk and spice trade that it began to spread into the Mediterranean, and then only where there was profitable trade. Islam's key cities and cultural centers remained focused upon the axis from Samarkand to Baghdad. One might say you could follow the camel and dhow to define the geographic spread and influence of Islam.

## A WAY OF LIFE

Islam derives its name from the Arabic words *Salm* or *Silm*. In both cases, it stands for submission, surrender, and peace. The two words derived from three Arabic



radicals *s-l-m*, which connotes peace among other meanings. When the letters are pronounced as *salima*, it means “to submit” or “to obey” and may also mean “to propose peace,” as in the Muslim greetings: *As-salam ‘alaykum*, or “May Allah’s peace abide with you.”

Succinctly put, Islam is a way of life based on peace and submission. It is based on a peaceful relationship between human beings and their creator, Allah, on the one hand; and a peaceful relationship between fellow human beings and other creatures, on the other hand. Islam therefore claims to have precepts that give sufficient guidelines to its votaries on all aspects of lives, spiritual and ephemeral.

It is also seen as a universal way of life that has evolved since the time of Prophet Adam, and all prophets mentioned in the “revealed scriptures” are regarded as Muslims: Prophets Adam, Ibrahim (Abraham), Nuh (Noah), Musa (Moses), and even cIsa (Jesus Christ) are referred to in various passages of the Qur’an as Muslims. The Prophet Yacqub (Jacob) is reported to have inducted his children into Islam and ensured, even on his deathbed, that they were counseled to remain steadfast as Muslims.

The sources of guidance (and information) in Islam are primarily the Qur’an and the Sunnah. Other sources of secondary importance derive their authorities from the two primary sources. Ijma, for example, as a secondary source, is based on the unanimity of all the learned Muslims in a particular age who have attained the level of Ijthad. Ijthad is the capacity for individual juridical interpretation upon a certain issue after the death of Muhammad, the prophet. The authority for Ijma is based on a prophetic statement that “my Ummah [community, society] will not agree on an error,” pointing to the fact that jurists among the Muslims will not be misguided while making decisions on issues of mutual importance to the Ummah.

Muslims see the Qur’an as the first primary source of guidance and information, as the original source from which all ordinances of Islam are drawn. The Qur’an is variously divided for easy reference. It has 114 *surahs*, each of which is begun with the verse “In The Name Of Allah...” except one, the 9th *surah*. It is also divided into 30 parts in which, each of them is referred to as a *juz’*, or 60 parts, each of which is called a *hizb*.

The Qur’an is seen as the compendium of all divine revelations issued to prophets before Muhammad, including 10 of such scriptures sent to Adam, 50 to Prophet Shith, while Prophet Idris received 30. Zabur,

Tawrah, Injil, and Qur’an were revealed to Prophets Daud, Musa, cIsa, and Muhammad. The Qur’an, from the perspective of Islam is the last divine revelation in form of a scripture, which was revealed at a time when human intellectual development attained the level of proper comprehension of the divine message. It thus contains guidance that will be useful for the human race till the end of time.

Islam sees every aspect of life as being noticed by Allah, be it mundane or spiritual, and for each of these aspects, commensurate recompense will be given for every action carried out. In order to prepare its adherents for a purposeful interpersonal relationship, it seeks to train them for this through the fundamental rituals and spiritual activities, which include *As-Salat* (canonical/contact prayer); *Az-Zakat* (compulsory alms); *Sawm* (compulsory fast during the holy month of Ramadan); and hajj (holy pilgrimage to Mecca and Medina).

## POLITICS AND ECONOMICS OF ISLAM

The Islamic provisions on most of the concepts of life adopt the medium position in all cases. This is why the Qur’an refers to a nation built on Islamic principles as a justly balanced nation. The political concept of Islam is such that it can operate under various systems if they are inherent with the Islamic polity. This includes the principle of *Tawhid*, in which sovereignty is for Allah and not the state; the principle of *Khilafah*, which states clearly that those in authority are only ruling in trust as vicegerents of Allah the Supreme; and the principle of *Shurrah*, which depicts that in all affairs of the state, the citizenry must be consulted and that the government should be constituted by the majority of the people.

The principle of *Akhirah* promotes accountability, a situation whereby those in authority are made to be conscious of the fact that accountability is twofold. With these principles in place in a federal, unitary, monarchical type of government, such government will be viewed as Islamically compliant.

The economic system in Islam is built on zero interest. Islam thus encourages charity and trade. In fact it incorporates the five pillars of the religion (*Zakaat*) in its economic system. It allows making profits through trade but frowns at multiplying wealth through usury or any form of exploitive tendencies. Instead of encouraging the rich to be idle and multiply their wealth through multiple interest accruing from loans given to the less fortunate, it encourages them to join them as partners in business, sharing both profits and losses.

The Islamic work ethic stipulates that an adherent should strive to earn his means of livelihood or any form of labor embarked upon and it is viewed as honorable even if a man performs menial tasks. Islam frowns at any form of begging, yet it does not close its doors to charity. Whenever the need arises, it urges its votaries to aid those who genuinely need assistance.

The socio-moral teaching in Islam is based on the abilities of the votaries to avoid shameful acts, openly or secretly, and to endeavor to abide by the standard of ethical norms given by the faith. Islam further presses its insistence that adherents should live by the fundamental principles. For examples, the Holy Prophet Muhammad was reported to have said in regard to *As-Salat* (contact prayer) and *As-Sawm* (compulsory fast) that whoever these would not inhibit from lewdness and indecent acts had no reason to embark on any of the principles at all.

#### ABUSE OF ISLAM

Moreover, on the social level, Islam encourages its votaries to relate to others in the best of manners, irrespective of their creed or color. The Prophet was reported to have vowed that he would stand against an oppressive Muslim and in defense of a *dhimmi* (a non-Muslim under the protection of an Islamic state) on the day of judgment. He also counseled that honoring one's neighbor or guest, irrespective of his or her religious affiliation constitutes an act of faith in Allah and the last day. If all these are part of the basis of Islamic social teachings, then it cannot support aggression or terrorism. Some Muslims, such as Osama bin Ladin and his terrorist organization, have abused Islamic teachings for their own purposes.

In history, Muslims were known to have ruled large parts of the world and their political impact ceased with the abolition of the caliphate in Turkey in 1927, during the reign of Kemal Atatürk. In the contemporary world, a few countries are still referred to as Islamic states using different versions of the interpretation of Islamic principles of government to administer their respective states. IRAN, LIBYA, and SAUDI ARABIA are good examples of these states.

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## island

AN ISLAND IS A LANDMASS smaller than a continent surrounded by water. The largest islands are GREENLAND, NEW GUINEA, BORNEO, MADAGASCAR, Baffin Island, and SUMATRA. The smallest islands are a few square miles or kilometers. An extended line of islands is an island chain. A cluster of islands is an archipelago. Islands are of either the continental, oceanic, or coral type.

A continental island is an exposed part of a continental shelf. The largest islands are of this type. Either tectonic subsidence or melting glaciers, or a combination of both, causes the edge of the ocean to spread over a continent to create islands. Narrow and shallow waters (straits) separate the islands from the larger landmass. During glacial periods, the sea level was much lower and land bridges joined such islands to continents. For this reason, continental islands' plants and wildlife, as well as their geology, are similar to those of the nearby mainland. Entire nations can be continental islands, such as IRELAND and MADAGASCAR. Other such islands can be parts of larger political entities. Vancouver Island, for instance, is part of the Canadian Province of British Columbia. Examples of prominent continental islands belonging to U.S. states are Kodiak Island (ALASKA) and Long Island (NEW YORK).

Continental islands do not have to be solid rock extensions of continents. Some are large deposits left by glaciers on continental shelves. For example, in the United States, part of Long Island, New York, is a glacier's terminal moraine and so are parts of Nantucket Island and Martha's Vineyard, MASSACHUSETTS. Additionally, ocean waves, and longshore currents deposit sand to form small-scale barrier islands that parallel shorelines. The U.S. southeast coast and gulf coast are classic examples of such shorelines.

An oceanic island is generally a single volcano, an assemblage of volcanoes, or a volcanic plateau that grew from the deep ocean floor rather than a continen-

tal shelf. Many island countries are oceanic islands, ranging from relatively large ones, such as ICELAND, NEW ZEALAND and PHILIPPINES, to smaller groupings, such as FIJI and FRENCH POLYNESIA.

It takes an enormous pile of lava to accumulate before a volcano or plateau breaches the surface water. Geographers call an oceanic island a high island because it is mountainous with rugged peaks. When a volcano of an oceanic island erupts, its flanks shudder spasmodically against the water to create seismic sea waves (TSUNAMIS). The largest TSUNAMI can travel across an ocean in a day and cause devastating floods and serious erosion on other islands and on mainland shores that lie in the wave's path.

Island-forming volcanism occurs in association with seafloor spreading, which is the movement of the oceanic lithosphere in opposite directions away from the mid ocean ridges. As a result, oceanic islands occur in three general locations: 1) on the mid-ocean ridge; 2) along edges of oceanic trenches; and 3) above stationary hot spots. The AZORES and ASCENSION are examples of islands sitting on the mid-ocean ridge. JAPAN and the Aleutian and Mariana islands are island arcs occurring on the edges of the oceanic trenches. The Hawaiian Islands are an island chain forming above a hot spot, a location where a plume of magma sits fixed in the mantle, just below a moving lithosphere.

Coral islands are made of former coral reefs. Reefs are ridges of rock or coral that are at or near the water's surface. A coral reef is an accumulation of the skeletal remains of coral polyps (invertebrate animals). Reef-building corals live in tropical waters, so coral islands are in relatively low latitudes. When corals die, their lime skeletons remain behind to build reefs made of limestone. The remains of an immense number of coral polyps make up a single reef. The reefs grow so large and in such abundance that they can become small islands. Geographers call coral islands "low islands" for their lack of mountainous relief.

Coral islands appear on continental shelves and in the deep ocean. Continental coral islands are the high parts of large limestone platforms situated on continental shelves. People living in the Caribbean call these islands cays. In FLORIDA, people call them "keys" as in Florida Keys. The islands associated with the GREAT BARRIER REEF in AUSTRALIA are also on a limestone platform. Other coral islands appear far out at sea as atolls. An atoll consists of a ring-shaped island that sits like a crown atop a submerged volcano. The volcano was once an island with a coral reef growing around its outer edge, but the seafloor slowly sank, taking the vol-

cano below sea level. The reef grew upward as fast as the volcano subsided, and thus became a circular atoll. Virtually all atolls are in the PACIFIC OCEAN, owing to the scarcity of volcanism and seafloor subsidence in the other oceans.

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## Isphahan

FOR THE LAST 900 years, Isphahan (Isfahan, Esfahan) has been the capital of the province of the same name in the center of the empire that was known as Persia, now IRAN. The city lies in a basin at an altitude of 5,150 ft (1,570 m) above sea level in the foothills of the ZAGROS MOUNTAINS. The region is desert punctuated by numerous oases that were the source of sustenance for the caravans that once traversed central Asia.

Isphahan is one such oasis that lies on the banks of the Zayandeh River, 272 mi (435 km) from Tehran, Iran's capital. It is the third-largest city of Iran, with a population of about 1.5 million and was acclaimed as a beautiful city in the 16th century by its inhabitants, whose phrase *Esfahan nesf-e Jahan* ("Esfahan is half the world") is frequently repeated today.

Isphahan was founded more than 2,000 years ago and because of its location and resources, it has experienced many invasions and changes of fortune. It was originally known as Aspadana and was an important center in Sassanian times, between 200 and 650 years C.E. It was taken by invading Arabs in the 7th century when Islam was established and when Isphahan became the provincial capital. Four hundred years, later it was annexed by Seljuk Turks when it rose in stature to become the capital of their empire. Like so many cities of central Asia, Isphahan was then captured by the Mongols under Genghis Khan in the 1220s and then by Tamerlane in 1338, when it was reputed that 70,000 people were killed.

Its golden age of artistic and architectural achievement began under Shah Abbas during the period of ap-

proximately 1587 to 1621 of the Safavid dynasty, which had been established in Persia in 1502. Mosques, palaces, gardens, and bridges were constructed, carpet making and artistic endeavors were encouraged, and the city increased its wealth. Its population swelled to about 600,000, and it became one of the great metropolises of the time.

Its heyday was short-lived, as it was taken by the Afghans in 1723 with much bloodshed. It lost its status as the capital, which was bestowed on Shiraz. Following 200 years of relative peace, Russians occupied Isphahan in 1916.

Modern Isphahan is still dominated by the art and architectural heritage of Shah Abbas. Among the most famous world-class sights are Imam Square, with its bazaars, mosques, and flower gardens; the Friday Mosque, Imam Mosque, and Hakim Mosque; Madraseh-ye Emami and Madrasah-ye Mulla Abdollah; as well as numerous minarets, teahouses, mausoleums, palaces, and museums. They attract visitors from throughout world, and its handicrafts, which include carpets, silver- and copperware, and miniature paintings, are much prized. Its industries also reflect the rich agriculture of its oasis HINTERLAND and its location for trade. Iron and steel production, established in 1971, reflects a degree of industrialization in this rapidly expanding city.

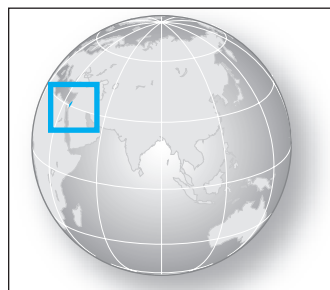
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## Israel

**Map Page** 1121 **Area** 8,019 square mi (20,770 square km) **Population** 6,116,553 **Capital** Jerusalem **Highest Point** 3,974 ft (1,208 m) **Lowest Point** -1,338 ft (-408 m) **GDP per capita** \$19,000 **Primary Natural Resources** timber, potash, copper ore.



THE STATE OF ISRAEL is located on the eastern shore of the MEDITERRANEAN SEA, bordering the Gaza Strip to the southwest, EGYPT to the southwest, the West Bank to the east, JORDAN to the east and southeast, SYRIA to the northwest, and LEBANON to the north. Israel is a parliamentary democracy with the Knesset as the legislature. The president serves as chief of state, while the prime minister serves as the head of government. Hebrew and Arabic serve as the official languages of Israel, but English is widely used as a foreign language. Jerusalem, Tel-Aviv, and Haifa are the major cities.

The landscape of Israel is varied. The coastal plain stretches from Gaza in the south to Haifa in the north, covering 291 mi (469 km). Mountains traverse north to south in the central part of the country. The Sharon Plain stretches from Haifa to the Yarkon River, from which begins the Shefala Plain, which continues through Gaza. The Jordan River is Israel's main source of water and forms the border with Jordan. The Negev Desert makes up the southern portion of the country. Northern Israel receives average rainfall of 39 in (1,000 mm), while Eilat receives .8 in (20 mm). The country is susceptible to sandstorms during the spring and summer and periodic earthquakes.

Israel was part of the FERTILE CRESCENT that stretched from Mesopotamia. The Hebrew-speaking Semitic people who became the Jews settled in this region 3,500 years ago. A Judean kingdom was founded by King David, which survived until 586 B.C.E. when the Babylonians destroyed the First Temple and Jerusalem and sent part of the population into exile. Thereafter, the region fell under the sway of Persians, Greeks, Romans, Muslims, Crusaders, and the Turks.

In 1897, Theodore Herzl, after witnessing European anti-Semitism, founded a Zionist movement, which called for a Jewish homeland in Palestine. Between 1882 and 1903, Jews from all over Europe settled in Palestine and founded communities. These new settlers faced problems of poor soil, lack of experience, and opposition from Arabs and Turks.

A turning point in the formation of Israel as a modern state came during World War I. When the war broke out in 1914, the Ottoman government began expelling Jewish settlers in PALESTINE, whom it declared "enemy aliens." On November 2, 1917, the Balfour Declaration established official British support of a "national home for the Jewish people." At the end of the war, the OTTOMAN EMPIRE was dismantled, and the League of Nations officially recognized the British Mandate for Palestine. In 1939, with war against Adolf



Hitler's Germany looming, Britain issued the White Paper, which voiced its support for the creation of an Arab state for all of Palestine, barring Jewish emigration to the area.

By February 18, 1947, the British government ended the mandate on Palestine, leaving its fate to be decided by the newly formed United Nations (UN). The new UN Security Council faced the decision of whether to vote on the partition of Palestine into a Jewish and Arab state. As a result of the influence of the United States, the Security Council voted for the partition of Palestine.

On May 14, 1948, David Ben-Gurion declared the independence of the State of Israel. Between 1948 and 1973, Israel fought a series of wars with American support against the Arab states in order to maintain its existence. After the Six Day War in 1967, Israel gained control of the West Bank and East Jerusalem from Jordan; Gaza Strip and the SINAI PENINSULA from Egypt, and the GOLAN HEIGHTS from Syria. After meeting in Camp David in 1977, Prime Minister Menachem Begin of Israel and President Anwar Sadat of Egypt signed the Israeli-Egyptian Peace Treaty in 1979, marking the first time Israel made peace with an Arab state.

Since 1979, there has been a movement toward securing peace between Israel and its Arab neighbors. In 1991, the Madrid Conference called for talks on a final peace settlement. In 1993, through the Oslo accords, Israel and the Palestinians worked toward ending occupation of the West Bank and the Gaza Strip, paving the way for a Palestinian state. In 1994, Israel signed a peace treaty with Jordan. However, by September 2000, renewed hostilities flared between Palestinians and Israel, undermining the gains that had been made toward a permanent settlement.

The Israeli population is 80 percent Jewish. Of that percentage, 32 percent is from Europe, while 15 percent is of Asian descent and 13 percent is of African descent. The remainder of Israel's population is mostly Arab.

Israel has a market economy that includes a significant government role in economic policy. There have been great advances in the increase of agricultural output despite its limited arable land. There has been a significant growth in the technological sector of the economy. The addition of Jews from the former Soviet Union has also revitalized the economy. However, the government has a sizable foreign debt, particularly with the UNITED STATES. Israel's economic prospects continue to be overshadowed by the uncertainty of the Israeli-Palestinian conflict.

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## Istanbul

THE CITY OF ISTANBUL in TURKEY has one of the most interesting and important physical locations of any city in the world, the crossroads of TRADE ROUTES by both water and land. It is the only city to straddle two continents, Europe and Asia, and has been at the center of regional commerce for nearly 3,000 years. As Constantinople, it was the most important city in the Western world after the fall of the Roman Empire in the West and was then transformed into the political center of the OTTOMAN EMPIRE, which dominated the eastern Mediterranean until its demise 1923.

The western bank of the Bosphorus, the narrow channel connecting the BLACK SEA and the Sea of Marmara, was first settled about 3,000 B.C.E. At its narrowest, the Bosphorus is only 2,640 ft (800 m) wide, an ideal location for a settlement to participate in and control any and all trade passing between the Black Sea and the MEDITERRANEAN. Greek colonists established cities on both sides of this channel in the 7th century B.C.E., Chalcedon on the east side, and a city named for one of their early leaders, Byzas, on the west bank. This city, taking the name Byzantium, was built above the finest natural harbor on the Bosphorus, a narrow inlet called the Golden Horn because of its curved shape and the amount of wealth that flowed across its piers. This is the heart of today's Istanbul and forms the northern boundary of the old city. Called Haliç in Turkish, and Keration in Greek, the six-mile-long Golden Horn dominated shipping then, as it does today. The city grew wealthy by charging tolls from any ship passing through the narrows of the Bosphorus.

Byzantium remained a fairly minor city until the 4th century C.E., when Roman emperor Constantine the Great chose the city as his new capital. Constantinople reached the height of its intellectual sophistication and architectural grandeur in the 6th century, under Emperor Justinian, who constructed some of the grandest buildings in the world, including the Church



*The Blue Mosque, completed in 1616, is one of the prominent landmarks of Istanbul in Turkey.*

of Hagia Sophia (“Holy Wisdom”), the largest church in Christendom. After nearly eight centuries of continual attacks, Constantinople fell to the Ottoman Turks in 1453 and became the center of Ottoman power in the eastern Mediterranean. While retaining the name Constantinople officially (Qostantiniyeh in Turkish), gradually the city began to be called Istanbul (or Stambul) locally, a corruption from the Greek words for “to the city.” It was also sometimes known to the Turks as Dersaadet, “Abode of Felicity,” known for its luxurious palaces and lush gardens. The Turkish sultans ruled a city whose climate was indeed felicitous, warm and not too dry, suitable for the extensive gardens that came to dominate much of the old city within the walls, known as the Surici. The city continued to thrive, with a population of about 500,000 in 1500.

Today, Istanbul is the principal city of Turkey, though it ceased to be the capital after the fall of the OTTOMAN EMPIRE in 1923. With a population exceeding 9 million, Istanbul ranks among the top 10 largest cities in the world. Istanbul is the capital of a *vilayet* (province) of the same name—officially changed from Constantinople only in 1930. The city has three main divisions: Old Istanbul (the city within the ancient and medieval walls), Galata-Beyoglu across the Golden Horn, and the Asian Quarters across the Bosphorus. The city is more heterogeneous than the rest of Turkey, with some of its quarters dominated by specific minorities: Greeks, Armenians, and others.

Istanbul proper encompasses a peninsula between the Golden Horn and the Sea of Marmara to the south,

from the old wall across the end of the peninsula in the west, to Sarayburnu (Palace Point) in the east. Where once there was a sea wall, Ottoman sultans built several elaborate palaces and gardens, the most famous being the Topkapi Palace, which is today one of the city’s major museums and tourist attractions.

### FAMOUS MOSQUES

The terrain for most of the city is very hilly, with mosques and funeral monuments built to crown most of the primary hills: the most famous mosques include Mehmet II and Yeni Cami (New Mosque). The main thoroughfare is the Divan Yolu, from the Hagia Sophia to the Bayezid II Mosque. Other tourist sites include the twin fortresses of Anadolu (“Asia”) and Rumeli (“Europe”) built by the Turks on the shores of the Bosphorus just before the conquest and the vast covered markets. The quarter of Eyüp, the supposed site of the tomb of the Prophet Mohammed, was for centuries the site of royal ceremonies and burials.

Galata-Beyoglu, on the northern shore of the Golden Horn, was historically the residence of foreign merchants, and is today the center of modern Istanbul, with its largest shops and hotels. Across the Bosphorus lie the Asiatic Quarters connected to the European side by two major suspension bridges. Smaller residential and industrial towns line the Bosphorus on both sides, and along the northern edge of the Sea of Marmara, a sector of beach resorts and summer homes.

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## Italy

**Map Page** 1131 **Area** 116,306 square mi (301,230 square km) **Population** 57.6 million **Capital** Rome **Highest Point** 15,577 ft (4,748 m) **Lowest Point** 0 m **GDP per capita** \$8,914 **Primary Natural Resources** limited natural gas, minerals, beef, arable land.



ITALY, IN SOUTHWESTERN Europe, is a peninsula bordered by FRANCE to the northwest, SWITZERLAND to the north, SLOVENIA to the northeast, the ADRIATIC SEA to the east, the Ionian Sea to the south, and the Tyrrhenian Sea to the west; its famous boot shape juts into the MEDITERRANEAN SEA. In both its physical and human geographic expressions, Italy presents a distinct and immediately recognizable character. Italy's landscape has provided the scene for the Roman republic and empire, and its peninsular form has opened it to commerce, culture, and war. The geography of Italy colored the background of Renaissance art and has been the setting for fragmented city-states and a unified state. The geography of Italy today is a rich story of a people and a land that not only coexist but that are strongly tied together by history and opportunity.

Italy occupies the entirety of a peninsula extending southward from the European continent into the Mediterranean Sea, in addition to two large—and many small— islands. The Italian (or Apennine) peninsula is bounded by the highest crest of the ALPS in the north and northwest. These ranges curve to the south and southeast forming the Apennine ranges which serve as the structural framework of the peninsula. Within the curve created by these mountains is the Po River valley, the largest valley on the Mediterranean.

Drainage from the mountains fills several large lakes; among them Lakes Como, Maggiore, and Garda in the north and Lakes Trasimeno, Bracciano, and Bolseno in the central part of the country. Surrounding the peninsula, the Mediterranean Sea is divided into several distinct parts: the Adriatic Sea, with Italy to the west and the former Yugoslavia and ALBANIA to the east; the Ionian Sea, between the southern tip of Italy and Greece; the Tyrrhenian Sea to the west of the peninsula containing the large islands of Sicily and Sardinia; and the Ligurian Sea, between the island of Corsica (French) and the northwestern coastline of Italy.

Italy's climate and weather are typical of Mediterranean climate regimes. The range of temperatures throughout the year is 43 degrees F (24 degrees C) in the north and only 26 degrees F (14 degrees C) in the south. Winter temperatures in the north can average below freezing, while southern low temperatures can be substantially above that mark. The cooling effects of altitude are felt in the Alpine and Apennine highlands. Rainfall is sufficient for agriculture in most of the country with up to 52 in (1270 cm) at some locations in the north, down to 30 in (76 cm) or less in the south. The dry summer season extends over at least June, July, and August in the south, and during these periods irri-



*As one of the major water-traffic corridors in the city, the Grand Canal is the largest waterway in Venice.*

gation can be necessary for agriculture, and increases in population can strain the limited water resources.

The Italian landscape is considerably wooded, with 34 percent of the total land area forested; 9.25 percent of the land is engaged in permanent agriculture, while an additional 28 percent of the land is arable. In addition to agricultural potential, Italy's natural resources include limited supplies of mercury, potash, marble, sulfur, natural gas and crude oil reserves, fish stocks, and coal.

Most of the extreme events that occur in Italy are related to its regional physical geographic characteristics. Heavy rains are associated with landslides and mudflows where steep mountainous terrain predominates and with flooding in river valleys and coastal lowlands. Heavy snowfall in the north can generate conditions suitable for avalanches. Active volcanoes are not uncommon in the south; examples include Mount Etna on Sicily, Mount Vesuvius, and Stromboli. Many of the smaller islands have been forged from volcanic activity and such activity continues to the present. Earthquakes can accompany volcanic activity and the associated tectonic movement. Land subsidence is of concern in some coastal areas, most notably in the city of Venice on the Adriatic Sea.

The people of Italy are as distinct as their physical geographic environment. Although some of the prevailing demographic trends in Italy are similar to those of the European continent as a whole, there are many elements of Italy's human geographic character that are wholly unique. In terms of population statistics, Italy



has an aging population with a declining rate of natural increase. That is, their death rate is greater than their birth rate, leading to declining population numbers in the absence of immigration. There is, however, substantial immigration into Italy, particularly from Eastern Europe, Africa, and the MIDDLE EAST.

The Italian language—which does not predominate in any other country of the world—is in the Romance group of the Indo-European language family. There are small areas in northern Italy where French, German, and Slovene are the predominant languages. The population is overwhelmingly Catholic, with the VATICAN CITY in Rome as the administrative center of the Catholic Church. There are small Protestant and Jewish communities and a growing Islamic immigrant community.

Politically, Italy has historically been at one time the heart of an empire, at another a loosely connected set of regional fiefdoms, and at still another the victim of fascist totalitarianism. Today, Italy is a democratic republic. The Italian federal government employs a parliamentary system, with a president and a prime minister. Parliament consists of two houses, the senate and the chamber of deputies. There are several dozen active political parties seeking seats in those houses. There are 20 regional governments with varying amounts of regional autonomy, and a large number of municipal political institutions.

Internationally, Italy is a member of the EUROPEAN UNION and of the NORTH ATLANTIC TREATY ORGANIZATION (NATO). Italy was comparatively late in securing African colonies but did so in the case of ERITREA, and in part Ethiopia and Somalia. These colonial claims were lost at the close of World War II, but even so, there are substantial political and economic ties between Italy and Eritrea to this day.

### ECONOMIC GEOGRAPHY

Italy's capitalist economic system is based primarily on a diverse set of industrial activities. Generally speaking, the north of the country is heavily developed and industrialized (particularly in the cities of the Po River valley). Private development of manufacturing and processing dominate the economic activity in this region.

In contrast, the south of Italy is less industrialized and more dependent on agricultural activities. This re-

gion receives a greater share of social welfare subsidies to support the larger unemployed population. Some areas, both coastal and mountainous, are sought after as vacation locales by tourists from across Europe and around the world, and these areas depend on tourist spending for their economic base.

With Italy's limited supply of natural resources, most of the raw materials for processing goods—and the energy supplies with which to do so—must be imported. As a member of the European Union, Italy has followed a severe fiscal policy in recent years in order to meet the requirements of that international body. Italy accepted the euro as its sole currency for all transactions on January 1, 2002. Italy places a relatively high tax burden on its citizens in order to allow government support of the labor market and a generous pension system for retirees.

Italy's largest cities are centers of both economic and cultural activities. The capital, Rome, has been a metropolis through millennia. In addition to containing the Vatican City, Rome serves as the center for government and professional services and is an important cultural center. Both Florence in north-central Italy and Venice on the northern end of the Adriatic Sea serve as important centers of culture and history, in addition to supporting diverse economic activities. Turin, in the north, serves as an important center of manufacturing, and Milan, its neighbor to the east, is a center for transportation and business, notably the business of high fashion. Naples serves as the surrogate capital for southern Italy, while the islands of Sicily and Sardinia have concentrated metropolitan areas in Palermo and Cagliari, respectively.

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## Jakarta

JAKARTA, LOCATED on the island of JAVA, is the capital of INDONESIA and serves as a gateway to the country. Java is located in a chain of islands, with SUMATRA to the northwest, Bali to the east, BORNEO to the northeast, and CHRISTMAS ISLAND to the south. It is the world's 13th-largest island.

The huge city of Jakarta covers more than 410 square mi (650 square km) and has a population of over 9 million people. Besides serving as government headquarters, Jakarta is the center of Indonesian business and industry. Jakarta is different from other cities in Indonesia because it has the status of a province and its government is administered by a governor rather than a mayor.

Jakarta has a colorful history. As the port of Sunda Kalapa, it was the last Hindu kingdom in the area when the Portuguese arrived in 1522 to take advantage of the spice trade. Their tenure was short-lived, as they were driven out in 1527 by the Muslim leader Sunan Ganugjati. He named the city Jayakarta, meaning "City of Great Victory." By the early 17th century, both English and Dutch merchants were in the area. When the Dutch took over Indonesia, they changed the name to Batavia. In World War II, the Japanese captured the city and changed its name to Jakarta, mainly to gain the sympathy of the Indonesians. When the war ended



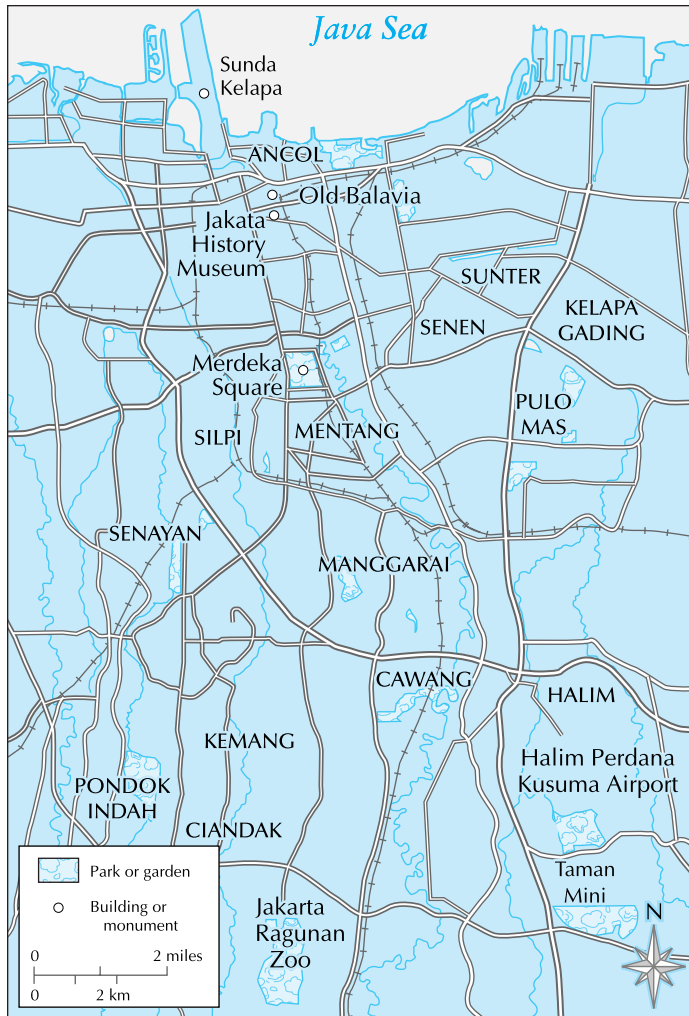
and Indonesia gained its freedom, the name *Jakarta* was retained.

The city has a definite cosmopolitan flavor and diverse culture. Jakarta attracts many immigrants whose cultures have contributed to the overall lifestyle of the city. The Taman Mini Indonesia Indah (Beautiful Indonesia in Miniature Park) pays tribute to the cultures of Indonesia's 27 provinces. The 250-acre (100-hectare) park is Jakarta's most visited attraction.

Jakarta's major problems are the result of the rapid growth of the city in the past 40 years. During that time, the population has skyrocketed from 2.7 million to over 9 million. The government has not been able to provide for the basic needs of its residents. Jakarta suffers from floods during the wet season, when sewage pipes and waterways become clogged with debris. The depletion of the RAINFOREST on the hills south of the city has also contributed to flooding.

### LIFE IN JAKARTA

About a third of Jakarta's population lives in abject poverty, many in squalid settlements made up of huts with earthen floors. They eke out a meager living by selling cigarettes, shining shoes, and scavenging food. The heat and smog of the city make it a hard existence. Traffic in Jakarta is horrendous, with motorcycles, three-wheeled taxis, dented buses, and pedicabs jockeying for position. Residents and tourists spend count-



The huge city of Jakarta covers more than 410 square mi (650 square km) and has a population of over 9 million people.

less hours stuck in traffic jams. In an attempt to reduce traffic jams, some major roads now allow only cars with at least three people to be operated during rush hour. Other forms of transportation include railroads. Two monorail systems are being built, and the government is considering a network of water buses along the canals of Jakarta.

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## Jakarta Triangle

THE JAKOTA TRIANGLE is an East Asian region comprising three countries: JAPAN, SOUTH KOREA, and TAIWAN. The concept originated with Harm de Blij and it has become popularized in the many editions of *Geography: Realms, Regions and Concepts*, first appearing in the 8th edition, published in 1997. The term *triangle* was inspired by the three-sided figure defined by the three capital cities of the region: TOKYO, Seoul and Taipei. But the Jakota triangle is unified by more than its three-cornered geometry. This group of East Asian states shares high population density, a high level of urbanization, rapid growth in manufacturing in spite of its dependence on imported raw materials, and lingering geopolitical problems that may be traced to the end of World War II.

The Jakota Triangle is distinctive for its high average population density. Yet each of the three member countries has a rugged and sparsely settled interior: Japan's 60 active volcanoes are legendary, most notable of which is Mount Fuji, a snow-capped stratovolcano rising to 12,388 ft (3,776 m). The eastern side of the Korean peninsula is dominated by the desolate spine formed by the Taebaek Mountains (Taebaek Sanmaek), just as the most conspicuous physiographic feature of eastern Taiwan is the Chungyang Mountains, which rise to 13,114 ft (3,997 m) at Yu Shan (also known as Mount Morrison). Thus the population distribution of the Jakota countries is uneven with extremely high densities along fertile coastal plains and river valleys and notable concentrations in massive rapidly growing cities.

The Jakota triangle countries have levels of urbanization ranging from 65 percent in Japan to 80 percent in Korea. This feature makes the region distinct from the remainder of East Asia and especially from China, which has less than 40 percent of its population in urban areas.

Tokyo, Seoul, and Taipei are massive primate cities; each is well over twice the size of the second largest urban center in the country and each accounts for about one-quarter of its nation's total population. Tokyo is the largest metropolitan area on the planet with a population of 35 million. Seoul is approaching megacity status with a population of 9.7 million, while Taiwan's capital is smaller with 6.5 million. The primate city dominance of the Jakota countries extends to their pivotal role as centers of political and financial power and leadership in industrial technology. The Jakota triangle countries are also distinguished by the

massive size and rapid growth of their manufacturing sectors, energy-intensive heavy manufacturing such as primary iron and steel and shipbuilding, labor-intensive light manufacturing such as textiles and garments, and traditional handicrafts such as paper, wood, and ceramic products. Just as notable has been the explosive growth in Jamaica exports of manufactured goods. Japan is now the world's second-largest manufacturing economy (after the UNITED STATES), while South Korea ranks seventh and Taiwan is in twelfth place. These nations are globally competitive because they have developed leading-edge manufacturing technologies and have highly skilled workers, an extremely low-cost structure, and aggressively entrepreneurial firms that are striving for world dominance in their industrial specialties. But surprisingly the Jamaica countries have achieved these industrial wonders with a modest resource base, and they remain highly dependent on imports of raw materials such as energy, minerals, agricultural commodities, and forest products.

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## Jamaica

**Map Page** 1137 **Area** 6,829 square mi (10,991 square km) **Population** 2,695,867 **Capital** Kingston **Highest Point** 7,401 ft (2,256 m) **Lowest Point** 0 m **GDP per capita** \$3,800 **Primary Natural Resources** bauxite, gypsum, limestone, sugarcane.



JAMAICA, SOME 62 mi (100 km) south of CUBA, is the third-largest island in the CARIBBEAN SEA and is full of numerous terrain features and vegetation. Surrounding the island is a coastal plain with numerous bays and broad flatlands, especially along the southern coast. Along the north coast, lush vegetation and white sandy beaches attract many visitors. The interior of the country is full of vales and deep ridges. Bush-covered hum-

mocks, sinkholes, and underground caves carve out the limestone-rich region. The Blue Mountains in the east provide a dramatic sight.

Numerous animals and plants are scattered throughout the lush land that supports a tropical moderate climate. The Jamaican hutia is the only native land mammal still alive and 20 species of bats inhabit the country. Crocodiles are found in the swamps, and lizards and frogs are present all across the island. Egrets are commonly seen flying through the air, and John Crows (turkey buzzards) are found in all areas. Woodpeckers, owls, and doves are also some other birds in the island. Throughout the surrounding waters, brain corals, soft-flowering corals, and over 700 species of fish are supported by the reefs in this part of the Caribbean Sea.

Christopher Columbus discovered Jamaica on May 4, 1494, and the Spanish controlled the island until the signing of the 1670 Treaty of Madrid, which handed direct power to the British. The British created a representative system of government, which gave the white settlers power to implement laws. This legislative system lasted until 1866.

Slavery in Jamaica lasted until 1834. By that year, the country consisted of more than 311,000 slaves and only around 16,700 whites. For almost 200 years, slaves were found throughout Jamaican sugar plantations. Estimates state that over 1 million slaves were transported from Africa to Jamaica during this period. Runaway slave communities were created on the island and they even fought successful small-scale battles against British soldiers.

With the decline of plantation life and rise of black revolts, the British government took direct control of the government. They implemented rules where landowners were required to produce titles of ownership. Many of the black peasants did not have the titles and were thus forced off their land. The plantation economy of Jamaica formed once again with the sugar and banana industries, and thousands of the blacks began to migrate to other countries.

In January 1958, Jamaica joined a collective West Indian state of nine British territories, the Federation of the West Indies. However, after a national referendum, Jamaica withdrew from the federation and began to negotiate with Britain for independence, which was ultimately granted in 1962. The Jamaica Labor Party (JLP) won the elections and Alexander Bustamante became the prime minister.

Throughout the 1960s, attempts were made to bring foreign manufacturing companies to the country.

The companies were given tax breaks, but many implemented racist policies, which gave white workers higher positions. In 1972, the JLP was voted out of office, and the progressive party, PNP, returned, led by Michael Manley.

Manley began a program of democratic socialism. Foreign companies were nationalized and employment policies were revised with blacks gaining higher positions in companies. Education was also funded by the government. Middle- and upper-class residents fled the country, and Jamaica fell into an economic crisis. In 1980, political violence swept throughout the country, and the JLP, led by Edward Seaga regained power. The new government abolished many of the social programs and implemented new strategies to bring in foreign assistance.

The PNP and Manley returned to power in 1989. In 1992, Manley retired and Percival James Patterson became the first black to hold the post of prime minister. Patterson currently remains in this position and the Jamaica government continues to attempt to revive the poor economy and end the rising unemployment throughout the country.

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## Japan

**Map Page** 1120 **Area** 145,843 square mi (377,835 square km) **Population** 127,214,499 **Capital** Tokyo **Highest Point** 12,389 ft (3,776 m) **Lowest Point** -13 ft (-4 m) **GDP per capita** \$28,700 **Primary Natural Resources** coal, copper, rice, sugar beets.



JAPAN IS AN ISLAND nation occupying a long, relatively narrow mountainous archipelago of four large and about 3,000 smaller islands on the northwestern edge of the PACIFIC OCEAN. The main chain of islands

hugs the coast of the Asian continent from RUSSIA in the northeast to CHINA in the southwest for about 2,361 mi (3,800 km). From north to south, the four largest islands, constituting about 98 percent of Japanese territory, are HOKKAIDÔ, Honshû (the main island), Shikoku, and Kyûshû.

Separating Japan from the mainland are the Sea of Okhotsk to the northwest, and the Sea of Japan and the East China Sea to the west. The closest point of contact with continental Asia is with the Korean Peninsula, about 124 mi (200 km) across the Korea Strait. Extending 603 mi (970 km) further south from Kyûshû (almost to TAIWAN) are the more than 200 Ryûkyû Islands, administered as Okinawa Prefecture, after the name of the largest island. Far to the southeast, in the Pacific north of the Marianas lie Iwo Jima and the small group of Bonin Islands (known as the Ogasawara Islands in Japan).

Although Japan looks small alongside its huge neighbor of China, it is larger than any of the countries of Europe. Its area is slightly smaller than California.

Japan emerged in the 6th century C.E. as a variant of the great East Asian civilization developed in ancient China. Its relative closeness to the continent of Asia facilitated the borrowing of China's sophisticated language and institutions, but the distances were far enough that in premodern times Japan was also fairly isolated from affairs on the continent. The country was never successfully invaded from the continent (the famous failed attempt of the Mongol Empire to extend its rule over Japan in the 13th century was the only serious attempt to do so).

Thus, Japan was both part of the Asian civilization derived from China but had a distinct insular (island) character. Some observers see Japan as remaining insular, if not provincial, to this day and compare Japan's national character to that of Great Britain (although the distance separating Japan from Asia is five times the distance between England and the European continent).

Japan's natural isolation in the world was magnified by its artificial isolation due to a political decision in the early 17th century to impose the "closed-country" policy, expelling Christians and restricting contact with the West to a single Dutch fleet a year. The closed-country policy lasted until the middle of the 19th century—200 years of willful isolation from outside developments.

The mapping of the land and systematic observation of Japanese geography began quite early, in the 8th century, when the government compiled regional



geographies (Fûdo-ki) for each of Japan's provinces (KUNI). But even though Japanese pirates terrorized the coasts of Asia at times, the country never emerged as a great maritime explorer. Overall, the Japanese have tended to be familiar with nearby waters, not far waters, engaging in fishing rather than exploring or seafaring. For the most part, the seas around Japan have served as boundaries rather than linkages with other lands. It was not until the 1700s that Japan charted its own coasts.

## TOPOGRAPHY

Three-quarters of Japan is covered by mountains. This mountainous terrain is the product of the country's geological origins. The Japanese islands were the product of plate tectonics, as the Pacific Plate and the Philippine Plate subducted (slid under) the eastern edge of the Eurasian Plate. After this process was already well under way, about 15 million years ago, the Sea of Japan opened in the gap between the emerging Japanese archipelago and the continent of Asia. The process of subduction is ongoing, driven by relentless if slow forces of PLATE TECTONICS. Japan's geological history also explains the abundant natural hot springs found throughout the country.

Seen from the ocean floor, the Japanese archipelago is the summit of huge underwater mountains, rising from the deepest trenches of the Pacific Ocean, sloping steeply away from Japan to depths of 33,000 ft (10,000 m) or more. From this perspective, the highest mountains in the world could be said to be in Japan. The Pacific Ocean side of Japan is rimmed with mountains ranging from 4,921 to 9,842 ft (1,500 to 3,000 m) high. Most of these mountains are volcanic, such as the country's highest peak, the symmetrical volcanic cone of Mount Fuji (dormant since 1707). The western, Sea of Japan side of the country has lower, more moderate mountains, rising to heights of 1,640 to 4,921 ft (500 to 1,500 m).

Some of the mountains of Japan are dormant volcanic cones, such as the beautiful Mt. Fuji. But dormant volcanoes can become active at any time. The southern island of Kyûshû has several active volcanoes, such as Mt. Aso. In 1990 another of these Kyûshû volcanoes, Mt. Unzen, suddenly became active after 198 years of dormancy. The previous time Mt. Unzen was active, in 1792, it generated an earthquake, landslide, and tidal wave (tsunami) that killed about 15,000. There have been nearly 1,300 recorded volcanic eruptions since the eruption of Mt. Aso in the year 710 C.E. Japan today remains an active locus of volcanic and

seismic activity. Japan has more than 40 active volcanoes, and the country experiences an average of more than 1,000 seismic events (earthquakes and tremors) a year. The most disastrous earthquake of modern times hit the Tokyo/Yokohama area in 1923, killing an estimated 140,000. The worst earthquake since the 1923 disaster devastated the Kôbe area in 1995, killing more than 6,000.

The mountainous origins of the archipelago makes flat areas rare. There are only five major plains, and none are very large. The Kantô Plain, by far the nation's largest, with an area of 8,078 square mi (13,000 square km), extends inland from TOKYO. The other plains, all much smaller, include the Nôbi Plain near Nagoya, the Kinki Plain near Osaka and Kyoto, the Sendai Plain in northeast Honshû, and the Ishikari Plain on Hokkaidô. The mountainous topography of the land also means that Japan's rivers are short, rapid, and torrential, typically carrying significant amounts of water only in the spring and summer months. The longest river, the Shinano, is only 228 mi (367 km) in length. None of Japan's rivers is navigable for any significant length. Since Japanese mountains often rise directly from the water's edge, there are only two natural deep-water ports in Japan: Kôbe facing the Inland Sea, and Yokohama, just south of Tokyo.

Japan's rugged mountainous terrain and lack of any major rivers has impeded transportation and communication until modern times. Today's high-speed railway lines and highways are testimony to the extraordinary challenges and achievements of Japanese engineering. Long stretches of highways and rail lines are nearly continuous tunnels and bridges.

Most Japanese people are aware of the impact of geography on their island nation. They will often recite phrases such as "we live on a rocky archipelago with few natural resources." If Japan were a poor country today, people might point to its basic geographic features: a harsh and rocky island country with few natural resources. But while some modern Japanese continually stress how Japan is a harsh environment, stricken by earthquakes and volcanic eruptions and plagued by skimpy natural resources, this is more a problem in the 20th-century context of industrial Japan than in premodern times.

Japanese industry today is highly dependent on imported raw materials, especially petroleum, and the need to pay for those imports helps to explain the urgent drive to export. But Japan was self-sufficient for most of its long history, and even today, Japan, outside urban congestion, is not an especially harsh environ-

ment, but a lovely country. The nurturing and beneficent side of Japan's geography stems from its special climatic situation.

### CLIMATE AND POPULATION

Certainly, the high winds and torrential rains accompanying the seasonal typhoons (West Pacific hurricanes) that descend upon Japan can wreak terrible damage and destruction. But in general, climatic conditions have favored Japan. With the exception of parts of the northern island of Hokkaidô, Japan lies in the temperate climate zone. But there is tremendous regional variation, from semitropical regions in the south akin to northern FLORIDA to the cool temperate climate similar to New England in the northern regions. Indeed, as the distance between the northern island of Hokkaidô to the southern island of Kyûshû roughly corresponds to the distance between Maine and Florida, so do the climatic conditions of Japan vary to a corresponding degree.

In general, Japan is part of the monsoon climate region of coastal Asia. The monsoons are seasonal winds created by changes in temperature in the region. In the cold winter months, the air over Central Asia, far from the coastal waters, becomes very cool and dry. As heat rises, so does cold air sink, and this cool dry air sinks down over Asia, bringing cold dry air to the south and east. (The impact of these winter monsoon winds is somewhat different in one region of Japan, discussed below.)

In the warm summer months, the reverse movement takes place. The air over central Asia becomes warmer, rises up, hence pulling moist air from the coasts toward the interior of Asia. This drops often heavy amounts of rain on the eastern regions of Asia (including all of Japan except the very far north of Hokkaidô) in the warm months. In sharp contrast to the precipitation pattern of northwestern Europe, where rains tend to fall in the cold winter months, the monsoon-induced rains of Asia fall exactly in the summer growing season. It is these rains that enable the wet paddy-field rice agriculture that has supported such high populations in Japan and in Asia since premodern times.

Japan's arable land may be quite small—only about 12 percent of the total land area is suited for cultivation—but it has been highly productive. The oceans surrounding Japan have been another great source of foodstuffs, raw and cooked.

These rather fortuitous conditions have permitted a population of 40 or 50 million people in preindus-

trial times to live in an area about the size of MONTANA or California.

In terms of population, Japan has long been one of the world's biggest countries, dwarfed by China, but for centuries larger than all of the countries of Western Europe combined. Japan's population of about 127 million people today makes it the fifth-largest country in the world. The predominantly mountainous topography concentrates this large population on a very limited land area. The resultant very high population density make Japanese cities and towns among the most crowded in the world. The population is quite homogeneous, with only about 1 percent ethnic Koreans and other minority groups. (An estimated 16,000 Ainu, descendants of the original inhabitants of northern Japan, survive, mostly on the northern island of Hokkaidô.)

### JAPAN'S EIGHT REGIONS

The different regions of Japan are strikingly diverse and have distinct climatic and topographical characteristics. The country's 47 prefectures are often grouped into eight separate regions, three for the outlying major islands, and five within the main island of Honshû.

1. The northern island of Hokkaidô has a far less-dense population and a colder climate than the rest of Japan. Some of Hokkaidô's other features stem from its late development. Hokkaidô constitutes nearly 21 percent of Japan's total land area, yet is home to only 5 percent of the Japanese population (5.7 million). The landscape includes soaring volcanic mountains, much hilly lowland, and flat terraces near the coasts, unlike terrain anywhere else in Japan. Agriculture, fishing, and tourism dominate Hokkaidô's economy. Unlike the rest of the country, there is little industry in this northern island. The only major city in Hokkaidô is the prefecture's capital, Sapporo, with a population of about 1.7 million. (Sapporo is the largest Japanese city north of Tokyo.) Japan's northernmost island is separated by the Tsugaru Straits from Honshû.

2. Moving south across the Tsugaru Straits to the main island of Honshû, one enters the region known as Tôhoku (literally "Northeast"). Tôhoku occupies an intermediate position between Hokkaidô and the central region of Honshû in more ways than one. The region constitutes about 18 percent of Japan's land area (slightly less than Hokkaidô) but has about 10 percent of its population (twice Hokkaidô's). Hence, the region's population density of 235 persons per square mi (46 persons per square km) is almost three times that of Hokkaidô's, but substantially less than in other

parts of Japan. Tōhoku includes six prefectures but, like Hokkaidō, is relatively underdeveloped when compared to the rest of Japan, with more of the population engaged in agriculture and less in manufacturing than in more developed regions. Like most of Japan, Tōhoku is hilly and mountainous, with few substantial plains or other flat areas. Like Hokkaidō, Tōhoku produces rice and attracts many tourists.

3. Southwest of Tōhoku is Chūbu (literally “the central part”), the large central region of Japan (and the widest part of the big island of Honshū). In this central zone, the terrain varies tremendously. There are four major subregions within this central zone. The mountainous region of Chūbu is the “rooftop” of Honshū, capped by the massive Hida, Kiso, and Akaishi mountain ranges that constitute the Japanese Alps. Many peaks in the Alps have elevations above 9,843 ft (3,000 m), and are snow-covered for most of the year. There are few flat areas in the mountainous parts of Chūbu, so the population is clustered in six small mountainous basins, where residents traditionally were engaged in silk production. The contrast with the Kantō region of Chūbu could hardly be greater. The Kantō region includes by far the largest flat area of the country, the Kantō Plain, extending inward from Tokyo, as well as many of the major manufacturing and population centers along the Pacific coast. The Kantō region includes seven prefectures and great concentrations of modern industry. Its population density is also by far the highest in the land.

4. Extending south from the Kantō region along the Pacific is the Tōkai region, a quieter and less developed part of central Japan, comprising three prefectures. The most important part of the Tōkai is a narrow band of land between the ocean and the mountains. The old Tōkaidō Highway traversed this strip in the Tokugawa period (1600–1868), and modern highways and railways still follow that route today. Further to the southwest in the Tōkai lie the second-largest flat part of Honshū, the Nōbi Plain, along with Japan’s third-largest city, Nagoya.

The final region of the Chūbu, the narrow band of hilly country north of the Alps and adjacent to the Japan Sea, is known as Hokuriku, which encompasses four prefectures. The Tōkai region is much less developed than the superadvanced industrial zones of the Kantō, but the isolated Hokuriku region, on the “back side” of Japan, is even slower and less developed, although somewhat ahead of the northern Tōhoku region. The Hokuriku region is characterized by damp winter air and enormously heavy snowfall, as the win-



*A religious shrine near Miyajima Island, Japan, symbolizes the rich and ancient mixture in the country's cultural geography.*

ter monsoon winds passing over the Sea of Japan drop their wet cold snow on the region in sometimes astonishing quantities.

5. Moving further west along Honshū brings us to the region of Kansai. (Kansai, especially the part near the old capital of Kyoto is also referred to as Kinki.) From this area south, the subtropical climate of this part of Japan sets it apart from lands to the north and east. The southwestern part of Honshū is divided into the Kansai and Chūgoku regions, but the climatic tendency toward warm sunny weather generally affects the two islands of Shikoku and Kyūshū as well.

The Kansai region is the second most densely populated and developed part of Japan after Kantō. Not only was this region the center of premodern Japan, it was home to the imperial capital of Kyoto for a thousand years. It is also a modern commercial and industrial zone. It encompasses six prefectures and three of the country’s largest cities, Kyoto, Osaka, and Kōbe. Kansai also features Japan’s largest freshwater body, Lake Biwa, source of water for Kyoto to its south. The ancient capitals of Kyoto and Nara, along with the nearby regions, are among Japan’s most-visited tourist destinations, for their temples, historical sites, and long pedigree.

Osaka, merchant city of the Tokugawa age, remains a major industrial and commercial center, second only to metropolitan Tokyo. Though great quantities of goods are transshipped at Osaka, nearby Kōbe is one of Japan’s two great natural harbors (along with Yokohama), and serves as the main trading ENTREPOT for western Japan.

6. Continuing to the southwest from Kansai we arrive at the tip of Honshû and the region known as Chûgoku. Usually divided into San'in ("shady side") facing the Sea of Japan to the north, and the San'yô ("sunny side"), facing the warm shallow waters of the Inland Sea to the south, Chûgoku is also home to the major industrial city of Hiroshima. Beyond Chûgoku lie the large islands of Kyûshû to the far west, and Shikoku to the south. Encircled by the three is the Inland Sea, which has served as a protected waterway since prehistoric times.

7. There are four prefectures on Shikoku, the smallest of Japan's four main islands. Shikoku's climate is even more subtropical than the Kinki region, and its agriculture includes mandarin oranges and other warm-weather crops. The island was also site of the traditional pilgrimage around the 88 Buddhist temples and monasteries of the island. Today's pilgrims often make the same voyage not on foot but via tour bus. Shikoku remains less developed than the Chûgoku section of Honshû, which prompted the government to build the spectacular Seto-Ôhashi Bridge linking the island with Honshû via Awaji Island. Whether this bridge, or the proposal for a highway bypass along Shikoku's northern shore, will bring further development is unclear.

8. Finally, at the southwestern tip of the main cluster of Japanese islands, Kyûshû is Japan's third largest island, divided into seven prefectures. As we have seen, Kyûshû has some of Japan's most active volcanoes and other mountains.

In northwest Kyûshû are major coal fields (second only to Hokkaidô in production of coal) that provide much of Japan's energy and are the location of major iron and steel plants. The island is mostly divided between an industrial north and an agricultural south. Kyûshû's major cities include Fukuoka, Kitakyûshû, and the port city of Nagasaki. Between Kyûshû and the largest island of Honshû is the Shimonoseki Strait, spanned in modern times by the Kammon Bridge and three separate tunnels.

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## Java

WITH A population exceeding 120 million, crowded into a space about the size of NEW YORK state (but with nearly six times the population), the island of Java is one of the most densely populated places on Earth (2,070 inhabitants per square mi or 864 per square km). Java is not the largest of the islands of INDONESIA, but it is certainly the nation's political, historical, and economic core, with 60 percent of Indonesia's total population, and most of its wealth concentrated into less than 7 percent of the nation's total land area. But the future may change this status, as mineral and fossil fuel wealth in the outer islands leads to increased migration away from Java and increased demands for political and economic autonomy.

The 13th-largest island in the world, Java is the fifth-largest island in the Malay Archipelago. It is the smallest of the Greater Sundas (which also include BORNEO, SUMATRA, and Sulawesi), with a total area of 48,830 square mi (125,205 square km). The island is bordered on the south by the INDIAN OCEAN, which drops relatively quickly to great depths, plummeting up to 24,440 ft (7,450 m) in the Java Trench, the deepest point in the Indian Ocean. The rest of the island is surrounded by shallower seas, on the west, the Sunda Strait, with the island of Sumatra only 16 mi (26 km) distant; on the north, the Java Sea; and on the east, the Bali Strait, separating Java from Bali by only 1 mi (1.6 km) at its narrowest.

Part of the Pacific RING OF FIRE, Java was formed from a series of volcanoes running west to east. There are more than 100 volcanoes, 13 active in recent history. Most of the high peaks are concentrated along the southern edge of the island, about 20 of which exceed 8,000 ft (2,424 m). Semeru, in the eastern part of the island, is the highest active volcano on Java (12,131 ft or 3,676 m) and erupted most recently in April 2004. Merapi erupted in 1994, killing 37 and forcing 6,000 to evacuate the area. The most notable, however, is located just offshore to the west: Krakatau, site of the largest volcanic explosion of modern times (in 1883,



killing 36,000 people in western Java and reddening the sky as far as Europe and America).

From the mountainous south, the island's topography then slopes generally downward toward the north shore, where there are more level and fertile plains, followed by mangrove swamps and ample harbors. Most agriculture and population centers are thus concentrated on the north shore. The mountains also contain significant natural resources, including tin, sulfur, asphalt, manganese, limestone and marble. Petroleum deposits are located near Rembang and Surabaya in the north and northeast, and on the island of Madura. Rice is cultivated across Java, along with sugarcane, though much of the island is covered with dense forests, rich in plant and animal wildlife like the Javanese tiger, and teak and mahogany trees. Ornithology is especially diverse, including numerous species of peacock, quail, heron, cuckoo, and hornbill. Temperatures can vary from the mountaintops to the lowlands by up to 20 degrees.

One in three Javanese lives in cities, four of which have over 1 million inhabitants. The largest of these is JAKARTA, the capital of Indonesia, with its port of Tanjung Priok, 6 mi (9 km) to the east. Jakarta has recently become the center of one of the world's densest and fastest growing conurbations, referred to as JABOTABEK (Jakarta, Bogor, Tangerang, and Bekasi), home to nearly 20 million people. Java's other largest cities include Surabaya, the second-largest and center of much of Java's industry and trade; Bandung, on a high plateau in the northwest, formerly the heart of Dutch coffee and tea plantations, and more recently home to high-tech industries such as aeronautics; and Semarang, the island's fastest-growing city, on the northern coast. Jogjakarta, in central Java, is a smaller city but has been the spiritual and cultural heart of Javanese culture for centuries, and its ancient palaces and temples continue to make this Java's main center for tourism.

Today, Java is almost entirely Muslim, but before Islam arrived in the area, the island was ruled by Hindu and Buddhist princes (Bali remains predominantly Hindu today). The name *Java* itself probably derives from a Sanskrit (ancient Hindu) word for the type of grain grown locally.

Numerous temples survive from this period, notably Prambanan (from the 10th century), and Borobudur, the largest Buddhist temple in the world. These princes were at their height in the 1300s, when the Majapahit Empire dominated the entire archipelago, and Malayan became the lingua franca for most

of southeast Asia. This empire was dismantled by waves of Arabic traders, until it disappeared altogether in 1518. Bantam and Mataram were the strongest sultanates in the region when the Europeans arrived in the late 16th century. The Dutch established themselves in 1619 at an old Javanese fort called Jakarta and renamed it Batavia.

Total control of Java was achieved in 1756 after the bloody Java War, followed by gradual assertion of Dutch control over the neighboring islands of Sumatra, Borneo, and the rest of what is now Indonesia by the end of the 19th century. External trade was controlled by Europeans, while internal trade was taken over by Chinese immigrants encouraged by the colonial administration. The Javanese economy was transformed into plantations for sugarcane—the largest producer in the world by the end of the nineteenth century. Conditions for the Javanese were rough under Dutch rule, and the Japanese occupation during World War II encouraged them to fight for independence, which was proclaimed in Jakarta in 1945 but not recognized by the Netherlands until 1949.

## ETHNIC GROUPS

Three major ethnic groups occupy the island, each with their own language: Sundanese in the west (including Jakarta), Javanese over most of central and eastern Java (with about 75 percent of the population), and Toba Batak in the northeast corner and on Madura. Javanese culture is famous for its shadow puppets and gamelan orchestras. These three groups are by far the largest ethnic groups in all of Indonesia (Javanese 45 percent, Sundanese 14 percent, and Madurese 7.5 percent), and their language formed the basis for the national language, Bahasa Indonesia.

Current issues facing the Javanese include controlling the population expansion; programs for reducing family sizes were begun in the 1960s, accompanied by government resettlement projects, which also has a secondary aim of attempting to "Javanize" the Outer Islands of Indonesia, particularly in sensitive areas like Aceh in Sumatra, West Papua, and Kalimantan, all with strong separatist movements. Farmers are especially encouraged to emigrate to the other islands, but face resistance from locals who resent dominance from Java, politically or culturally. While Java is by no means dependent on the Outer Islands for its existence, the central government in Jakarta is certainly concerned with the loss of potential riches as the mineral wealth of these regions becomes more commercially developed and exploited.

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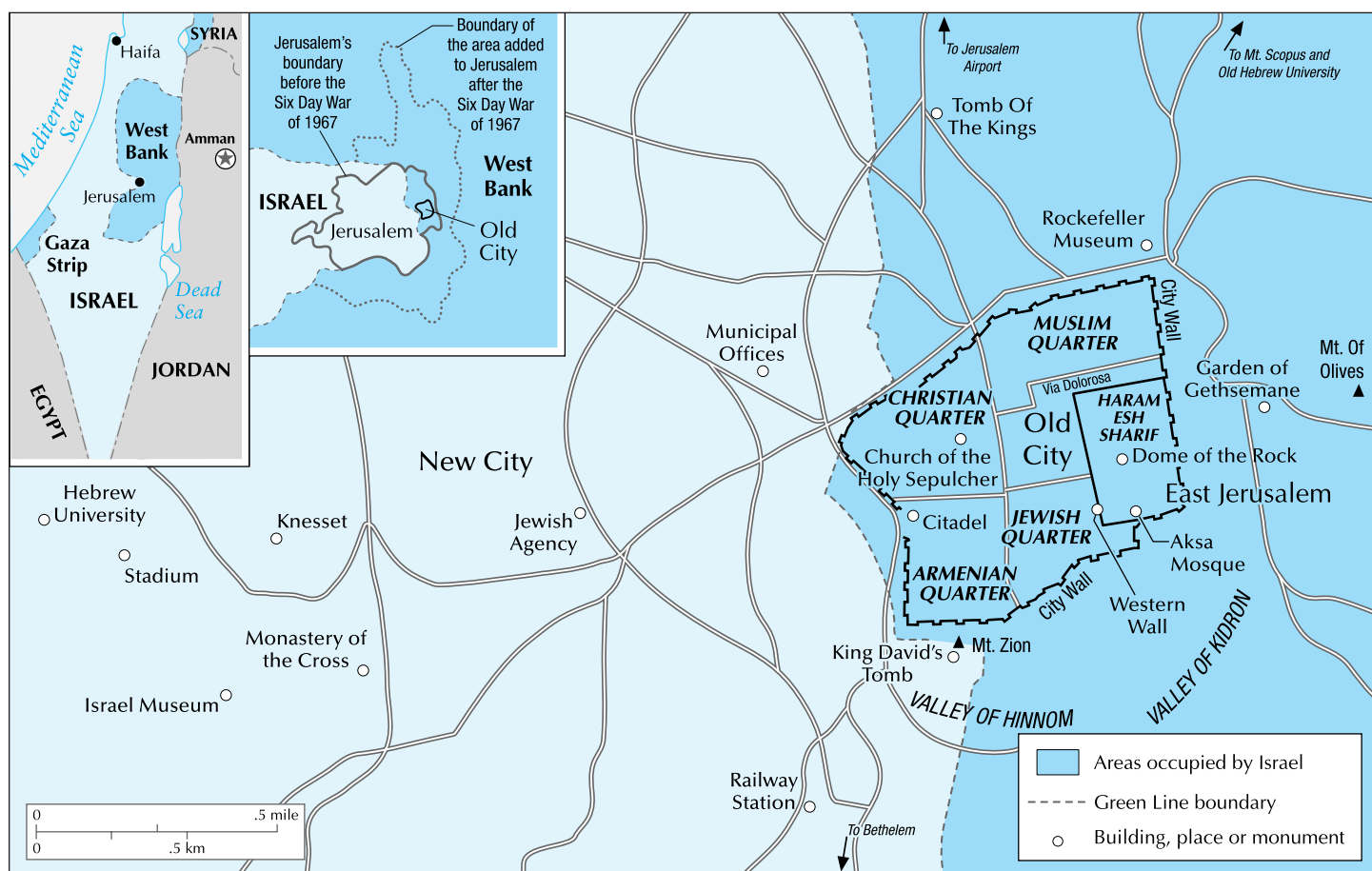
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## Jerusalem

THE CAPITAL CITY of the state of ISRAEL, Jerusalem is located in the center of the country. Jerusalem is Israel's largest city, with an area of 48 square mi (126 square km) and a population of 657,500 (2000), of which 68 percent are Jewish and 32 percent mostly

Arab. The city is divided into two components: West Jerusalem, or the New City, and East Jerusalem, or the Old City, annexed in 1967. Jerusalem is sacred to Judaism, Christianity, and Islam. The Wailing Wall, the Church of the Holy Sepulcher, and the Dome of the Rock are holy to Jews, Christians, and Muslims. In 1949, Prime Minister David Ben-Gurion declared Jerusalem to be the "eternal capital," and even though Costa Rica and Honduras hold embassies there, the United States and many countries hold their embassies in and around Tel-Aviv, the previous capital.

The site of present-day Jerusalem has been settled by humans since the Stone Age. According to Biblical tradition, King David captured the city from the Jebusites in approximately 1000 B.C.E. and made it the capital of the newly established Kingdom of Israel, until the destruction of the city and the First Temple by the Babylonians in 586 b.c.e. Jerusalem again became the capital of a short-lived Judean kingdom under the



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Maccabees in 142 B.C.E. It fell under Roman influence, and in 70 C.E., the Romans under General Titus destroyed the Second Temple during a rebellion. In 135, after the rebellion led by Simon Bar Kokhba, the Romans destroyed Jerusalem, renamed the city Aelia Capitolina, and expelled the Jews from Judea.

In 638, the Muslims gained control of Jerusalem. After the First Crusade in 1099, Jerusalem served as the capital of the Latin Kingdom of Jerusalem established by the Franks. Muslims regained Jerusalem under the Mamelukes in 1291 and by the Turks in 1517. In 1917, British troops took control of Jerusalem and established the British Mandate in Palestine. In 1949, with the end of the British Mandate, Jerusalem was divided into the New City, the capital of the new state of Israel and the Old City, under Jordanian control. Jerusalem was reunified after the Six Day War in 1967. Palestinians hope to see East Jerusalem as the capital of a Palestinian state. As part of the Oslo Accords in 1993, the fate of East Jerusalem was to be resolved by the Israelis and the Palestinians. However, renewed violence in 2000 has prevented such a settlement.

The city is the country's cultural center and is home to theaters, concert halls, and museums, notably the Yad Vashem, which chronicles the Holocaust, and the Israeli Museum, which holds the Dead Sea Scrolls. The Hebrew University has campuses in the Old City and the New City. Despite its turbulent history, Jerusalem continues to be a vibrant city.

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## jet stream

A JET STREAM IS A relatively narrow band of strong horizontal winds in the atmosphere. This band is 100 to 200 mi (250 to 500 km) wide and 1 to 2 mi (several km) deep. The winds in this band are stronger than those in horizontal or vertical regions adjacent to this band. The boundaries of the jet stream, therefore, con-

tain significant wind shear. Traditionally, the term jet stream has referred to such bands that occur in the upper troposphere, especially those that consist of westerly winds. There are other atmospheric phenomena that consist of bands of strong winds. The tropical easterly jet consists of easterly winds and is associated with the Asian monsoon. The polar night jet occurs during the winter in the stratosphere. Low-level jets form at the top of the planetary boundary layer—usually at a pressure of 900 to 800 mb. These jets have been associated with thunderstorm activity in many parts of the world.

Military pilots discovered the upper tropospheric westerly jet streams during World War II. Aircraft flying in an easterly direction would sometimes encounter winds so strong that they would seriously impede their mission. There are two types of these westerly jets: the subtropical jet and the polar front jet. The jet streams are located 30,000 to 40,000 ft (9 to 12 km) above the Earth's surface. They tend to be higher in summer than in winter and the subtropical jet is usually higher than the polar front jet. Meteorologists generally consider these jets to have wind speeds in excess of 60 mi (97 km) per hour. Average winds are about 135 mi (217 km) per hour in winter. The location of the most intense winds varies from day to day.

The subtropical jet stream forms as a result of the physical principle of the conservation of angular momentum. Figure skaters use this same principle to increase their spinning rate by bringing their arms towards the center of their bodies. Air is heated and rises over the part of the globe receiving the strongest solar radiation. At the top of the troposphere, this rising air moves toward the poles. As it moves toward the poles, the distance between it and the Earth's axis decreases. As this distance decreases, the air accelerates toward the west. The air reaches its maximum westward velocity between 20 and 40 degrees from the equator and then starts sinking. The latitude of maximum winds tends to be more poleward in the summer and more equatorward in the winter. Wintertime jets tend to have faster speeds than summertime jets. The intensity of the jet varies with longitude, but there is a tendency for it to be stronger off the east coast of Asia.

As its name implies, the polar front jet stream forms along the polar front, where warm air from the tropics meets cold air from the poles. The strong temperature contrasts that exist here cause south to north pressure gradient to increase with height. The intensity of the pressure gradient increases up to the troposphere. The Coriolis force then causes winds to go

from west to east. This jet stream is also more intense and located more poleward during the winter than during the summer.

Within both types of jet stream there are regions where winds are stronger than those located both upstream and downstream. Such an area is known as a jet maximum or jet streak. Air flows through the jet maximum accelerating in the entrance region and decelerating in the exit region at an average speed of 125 mi (201 km) per hour. The jet maximum has a distinct structure with areas of convergence in the poleward entrance region and equatorward exit region and areas of divergence in the poleward exit region and the equatorward entrance region. Below areas of divergence, especially the one on the poleward side, are especially favorable areas for midlatitude cyclones to develop.

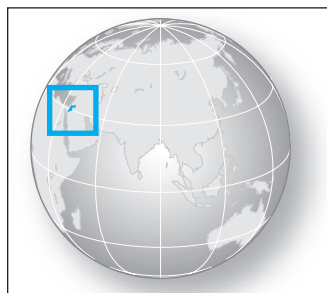
Jet streams affect our daily lives in other ways as well. Since the polar front jet stream is located where the north-south temperature gradient is strongest, places that are south of the current location of the jet stream tend to have warmer than normal temperatures and places to the north, colder than normal temperatures. The location of jet streams is very important to aviators. Aircraft flying with the jet stream can get a tailwind and aircraft flying against it, a headwind. These winds can significantly influence travel time and fuel consumption. The areas bordering jet streams have high wind shear and are prone to develop turbulence.

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## Jordan

**Map Page** 1121 **Area** 35,536 square mi (92,300 square km) **Capital** Amman **Population** 5,460,265 **Highest Point** 5,689 ft (1,734 m) **Lowest Point** -1,340 ft (-408 m) **GDP per capita** \$3,500 **Primary Natural Resources** phosphates, potash, shale.



JORDAN IS A MIDDLE Eastern country located in southwest Asia. Its official name is the Hashemite Kingdom of Jordan and it covers an area slightly smaller than INDIANA. SAUDI ARABIA borders it on the south, IRAQ on the east, SYRIA on the north, with ISRAEL and the West Bank territories (Palestinian Hills) on the east. Jordan is almost landlocked, with a small coastline on the Gulf of Aqabah, which is an arm of the RED SEA.

### JORDAN TRENCH

Jordan has two major land features—the Jordan Trench, and the Jordanian (Transjordan) Plateau. The Jordan Trench is a part of the Great Rift Valley extending from Syria to MOZAMBIQUE. It holds the Sea of Galilee, the Jordan River, and the DEAD SEA, all of which are below sea level. Shortly after the Jordan River leaves the Sea of Galilee it joins the Yarmuk River. The Yarmuk is Jordan River's principal tributary south of the Sea of Galilee, and the Kingdom's border with Syria. From there, the Jordan River meanders south until it empties into the Dead Sea; below sea level, it is the lowest surface area of the world. The lack of an outlet and the high level of evaporation have made the Dead Sea an area of extreme saltiness. It is mined for chemical resources including phosphates and potash.

South of the Dead Sea is the Dead Sea Valley (Wadi al-'Arabah). It stretches 111 mi (179 km) from the Dead Sea to the port of Aqabah. It is a very dry area with limited agricultural use. The Jordanian Plateau is the second prominent land feature. Most of Jordan lies on a tilted plateau. It rises abruptly at the eastern edge of the JORDAN VALLEY and the Dead Sea. The plateau's greatest heights are at the edge of the Dead Sea Valley. The heights range from 2,000 to 3,000 ft (610 to 915 m).

The Jordanian Plateau borders the Jordan Valley. Forests cover parts of the northwestern part of the plateau, while brush covers the central and southern sections. As it descends gradually to the south, east and north it becomes the Jordanian Desert Plateau. It ends in the Great Syrian Desert with little to identify the boundaries between Iraq, Syria, and Jordan. Grasses grow along the western edge, but much of it is featureless and arid.

The southern portion of the Jordanian Plateau is part of the Arabian Plateau. It has many deep canyons and mountain elevations rising to approximately 4,900 ft (1,500 m). The area holds the Wadi Rum, which has strange rock formations called jebels, and Petra, capi-



tal of the ancient Nabateans. The OTTOMAN EMPIRE built the Damascus-Medina Railroad (Hejaz Railway) in the region, which is still operating as a local line. During World War I, Colonel T.E. Lawrence, British army officer and leader in the Arab revolt, inflicted great damage on the Ottoman army along the rail line. Many scenes in the movie *Lawrence of Arabia* were shot here.

Jordan's climate is modified Mediterranean in the west. It has sharp seasonal variations in both temperature and precipitation. Temperatures below freezing often do occur in January in the plateau. The Jordan Valley has summer temperatures that may reach 120 degrees F (49 degrees C). Amman is usually moderate in temperature averaging 78 degrees F (26 degrees C). Most precipitation is rain (although snow and sleet are not uncommon) and falls in the winter season. It averages about 26 in (66 cm) in the northwest corner of the country to less than 5 in (12 cm) in the extreme east. The Jordan River Valley and the desert in the east receive less than 2 in (5 cm) of rain per year.

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## Jordan Valley

THE JORDAN VALLEY is part of the Great Rift Valley stretching from East Africa to northern SYRIA. Massive cracking of the Earth's crust caused by tectonic plate movements under the continents of Africa and Asia formed a trench over 4,000 mi (6,438 km) long. The northern section created by this faulting activity is the Jordan Trench.

In Syria, the Great Rift separates the Lebanon Mountains to the west and the Anti-Lebanon Mountains to the east. At Mount Hermon (9,232 ft or 2,814 m) melting snows and springs are the heads of the Jordan River, which traces the course of the Jordan Valley

to its mouth at the DEAD SEA. The distance from Mount Hermon to the Dead Sea is only about 120 air mi (193 km), but the surface distance is 223 mi (360 km) owing to the river's meandering.

The word *jordan* means, "that which goes down." The elevation drops from over 1,000 feet (305 m) above sea level at the foot of Mount Hermon to 1,340 ft (408 m) below sea level at the Dead Sea, which is the lowest surface area of the world. From Mount Hermon the Jordan River first descends to the basin of Lake Huleh, a dramatic drop in elevation of 900 ft (275 m) in a distance of about 10 mi (16 km). Lake Huleh was 3 or more mi (4.8 km) wide, but today it is a marshy area because the lake has been drained for agriculture. From Lake Huleh the Jordan River descends nearly 1,000 ft (305 m) through steep, rocky gorges. Just before entering the Sea of Galilee the descent slows and waters a plain near the village of Bet Zayda (Bethsaida). The Sea of Galilee (Lake Tiberias) is a freshwater body 689 ft (209 m) below sea level. When the Jordan River leaves the Sea of Galilee, it flows for about 24 mi (39 km) through a fertile region that supported a variety of agriculture in ancient times as it does today. It is also joined by the Yarmuk River soon after it leaves the Sea of Galilee.

The Yarmuk arises on the Transjordanian plateau and doubles the volume of the Jordan's waters. The volume of water varies considerably from the wet season to the dry.

South of ancient Pella the Jordan flows through the Ghor Plain, an ancient seabed composed of chalky limestone marls. As the Jordan descends to the Dead Sea, it is joined on its eastern (Jordanian) side by the Wadis Jurm, Kufrinjah, Rajeb, and finally by the Jab-bok River. In wet weather streams in the wadis come tumbling down from the granite Transjordanian Plateau. On the western (Israeli) side, the Jordan is joined as it flows south by the Wadis Bireh, Jalud, Malih, and Farah. The valley has several lateral faults that create the Jezreel Valley and the Saddle of Benjamin.

As the Jordan River flows south it traverses a number of geological and climatic zones. The descent to the Dead Sea is accompanied by an increase in temperature. The Jordan's southern end flows through badlands of soft gray saline marls. The whole rift valley floor is called the Ghor (Plains of Moab). Its narrow floodplain (Zor) contains thickets of thorn scrub and tamarish along its banks ("jungle of the Jordan").

The Dead Sea (Salt Sea or Sea of Arabah) is in the center of the Ghor Plain. At 1,340 ft (408 m) below sea

level it is the lowest surface area of the world. The Dead Sea Valley (Wadi al-‘Arabah) is an extension of the Jordan Valley. It stretches 111 mi (179 km) from the Dead Sea to the port of Aqabah. It is a very dry area with little agricultural value. The Jordan River Valley figures frequently in the landscape of the Bible. Numerous passages include the separation of Abraham and Lot, the Hebrew children crossing the Jordan to fight the Battle of Jericho, and the baptism of Jesus in the Jordan River.

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## Junngar Basin

THE JUNNGAR BASIN (also Dzungar) is one of the two major basins that make up much of northwestern CHINA's XINJIANG province (Xinjiang Uygur Autonomous Region). The basin, covering some 69,500 square mi (180,000 square km), is located to the north of the TIAN SHAN MOUNTAINS and has a mixed landscape that includes mountains, deserts, steppes, salt lakes and swamps. The region has much the same pattern as the TARIM BASIN, which is located to the south of the Tian Shan. However, because the Junngar is approximately 1,968 ft (600 meters) lower than the Tarim Basin, it is not quite as arid, receiving between 4 to 12 in (10 to 30 cm) of precipitation per year. In addition, there is also much greater snowfall and snow cover during the winter season, which helps increase the growth of natural vegetation.

The basin is triangular in shape, with the towering Tian Shan Mountains to the south, the Altai Mountains along the border with MONGOLIA to the northeast, and the Ala Tau Mountains along the border with RUS-

SIA and KAZAKHSTAN in the northwest. The Junngarian Gate, a rift valley in the Ala Tau Mountains, provides an outlet from the Junngar Plain to Lake Balkhash and Kazakhstan to the northwest. The gate is famous for its roaring winds that blow for more than 150 days per year. Between the sand desert at the basin's core and the gravel GOBI is a narrow plain often referred to as the "spring line," where the soil has some clay and silt, allowing limited agriculture and human settlement.

The basin is somewhat geographically cut off from CHINA proper. It is possible to travel over a pass between the Bogdo Ula and the Tian Shan at 3,600 meters high and descend into the Turfan area on the south. Otherwise, the route to China leads through some very desolate valleys parallel to the Altai Mountains in the east to the Mongolian Gobi. Because the slope of the area is to the west, all of the major rivers flow east to west. The upper waters of the Irtysh River, the only river in China that flows to the Arctic Ocean, provides access to Zaisan Nor and Semipalatinsk in Russia. The two main rivers flowing within the basin are the Manas and the Urungu.

These, together with numerous streams descend to the plains before being lost in the reedy marshes and sands of the basin proper. The high mountain ranges surrounding the basin receive as much as 30 in (75 cm) of precipitation a year. The Altai Mountains are notably forested, and the lower slopes covered with willows, poplars, alders, and white birch as you move higher. Above about 6,000 ft (1,800 m), the Siberian larch is dominant, with many of the trees more than 98 ft (30 m) in height. Given this heavy forest cover, the mountain areas bordering the basin are rich in fur-bearing animals such as fox, wolf, sable, ermine, bear, and wolverine.

In contrast to the Tarim Basin, where there are extensive desert lands between oases, the Junngar has a STEPPE and steppe-DESERT landscape with some natural vegetation in the wide valleys that border the central desert lands. Thus, nomadic pastoralism is practiced here as the dominant way of life. Because annual rainfall is typically less than 10 in (25 cm), the pastoralists must be constantly on the move in search of fresh grass. This is much different than in the Tarim Basin to the south of the Tian Shan, where human activity is oasis oriented and people move in trade-oriented patterns from oasis to oasis.

Despite the limited rainfall and desert conditions, major land reclamation projects have been undertaken to introduce arable farming to the region. About half of the reclaimed land is under cotton production, with

the rest in rice, wheat, corn, soybeans, various fruits, and sugar beets. However, more recent economic interest has centered on the discovery of oil at Karamai. Following the discovery of coal and iron deposits on the north side of the Tian Shan, there has been rather rapid industrial development over the past decades.

Urumchi, the capital of Xinjian Province, is located on the southern edge of the basin on a high desert plateau. Before 1949, it was a quiet market town of less than 60,000 people. But with the discovery of oil, coal, iron and significant gold deposits, the city has grown to more than 1.75 million. It is also a center for iron and steel, textiles, and fertilizer production. The other interesting area in Junngaria is the Ili Valley. Lying north of the Tian Shan, but cut off from the rest of the basin, the valley flows westward to Lake BALKHASH in Kazakhstan. Because of the westward

opening, the area is open to influence by more western climate characteristics, giving the area a special quality that supports arable farming and permanent settlements. The valley's high production of wheat and other grains has earned it the title of "the granary of Xinjiang."

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## Kalahari Desert

THE NAME *KALAHARI* is derived from the Tswana word *Kgalagadi*, meaning “the great thirst.” The Kalahari Desert, an arid region on the interior plateau of southern Africa, covers area in central and southwestern BOTSWANA, parts of west-central SOUTH AFRICA and eastern NAMIBIA, encompassing an area of about 100,000 square mi (260,000 square km).

The Kalahari Desert is part of a larger sand basin that extends into ANGOLA and ZAMBIA in the north, through Botswana into ZIMBABWE in the east, to the Orange River in South Africa, and west to the highlands of Namibia. The Kalahari is mostly flat, with an average elevation of about 3,000 ft (1,000 m) above sea level. The sands of the Kalahari are red, brown, or white by region. Parallel dunes run north to south or northwest to southeast, depending on the winds and cover large areas of the Kalahari. The dunes vary in height from about 20 (6 m) to 200 ft (60 m) are up to 50 mi (80 km) long, and are separated by chasms of varying width.

The Kalahari has a semiarid climate with frequent droughts. The region receives about 8 in (20 cm) of precipitation a year, mainly between the months of October and May. The rainfall pattern is unpredictable, and precipitation can vary by more than 100 percent between years. The rains generally come in the summer

months, September to March, as thunderstorms. Daytime temperatures range between 95 to 113 degrees F (35 to 45 degrees C) from October to March, which are the hottest months, and can drop below freezing between June and August. Temperatures ranges in the Kalahari Desert are some of the highest and lowest in southern Africa. The daily temperature ranges are also large.

The only permanent surface water in or around the Kalahari is the Boteti River. A swampy region exists on the northern border of the Kalahari in northern Botswana. Heavy rains occasionally flood the delta, and the Boteti carries the overflow east into Lake Xau and the Makgadikgadi Pan on the northeastern fringe of the desert. During the rainy seasons systems of streams and rivers flow temporarily. Water can be found below ground in the temporary waterways that flow into depressions in the desert, known as pans. Pans vary in size from a few meters to tens of kilometers in diameter and provide temporary sources of surface water. After heavy rain, these become pans or lakes, and water is then also found in mud-bottomed pools along the beds of the rivers. Pans also occur in craterlike depressions where rock rises above the desert sands.

Tough sun-bleached grasses grow in patches on the sand dunes. Other plant life consists of scrub bushes, patches of forest with fine leaf trees. The most amazing

plant found in the Kalahari is the watermelon. There are both the bitter and sweet varieties.

Wildlife includes the lion, leopard, hippopotamus, rhinoceros, buffalo, zebra, several kinds of antelope and gazelle, baboon, ostrich, spotted and brown hyena, wildebeest, elephant, giraffe, and eland. The hunting of these three last animals is prohibited, and for all game there are strictly enforced hunting seasons. Most animals are migratory, moving seasonally between sources of available water during the rainy season in summer.

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## Kamchatka Peninsula

RUSSIA'S FAR EAST IS MARKED by the large mountainous peninsula known as Kamchatka. Kamchatka peaks form one of the most volcanically active regions on earth, counting over thirty active cones, and at least a hundred more that are now inactive. Few people live in this remote corner of Asiatic Russia, where ties to central government, or any government at all, have traditionally been weak at best.

The Kamchatka Peninsula, 750 mi (1,200 km) in length, is formed of two parallel ridges of mountains, the northern extension of the Pacific RING OF FIRE, a continuation of a line of volcanoes stretching south across the Kuril Islands to the ranges of HOKKAIDŌ, JAPAN. The western range is older, and forms the central spine of the peninsula. The eastern range was formed more recently and contains most of the active volcanoes, notably in the Kluchevskaya Complex, where twelve cones create a plateau of ash and hardened lava that so resembles the landscape of the moon that it has been used as a testing site for Soviet lunar vehicles. Kluchevskaya Sopka, at 15,584 ft (4,750 m), is the tallest volcano in Eurasia.

This intensely active region—bubbling with mud pools, geysers, sulfur springs and fumaroles—is caused by the collision of the Pacific and Eurasian plates of the earth's crust, plus the jointure with another active tec-

tonic fault that runs from here to the east, forming Alaska's ALEUTIAN ISLANDS.

Kamchatka is joined to the mainland of Russia by a narrow isthmus, approximately 60 mi (110 km) wide. To the north lies the Koryak Plateau and the Chukchi Autonomous Republic, the land of Russia's Arctic nomads, similar to Alaskan natives. Kamchatka itself is populated partially by indigenous Koryak tribes, and by Russians. Its population of roughly 250,000 live mostly in the regional capital, Petropavlovsk-Kamchatskiy, or in small coastal settlements. The eastern coastline borders the PACIFIC ocean and its subsidiary, the Bering Sea, and is roughly indented with bays and steep inclines resulting from the presence of the eastern mountain chain and individual volcanoes. The western coast is, by contrast, smooth and low in elevation, with numerous swamps, tallgrass meadows, and swift rivers. The largest river, the Kamchatka, is not on this plain but runs south to north between the western and eastern ranges before turning east to empty into the Pacific at the peninsula's only other city of significance, Ust' Kamchatsk.

Russian expansion to the Pacific was checked in the mid-17th century along the AMUR RIVER by the Chinese, so trappers, merchants and adventurers turned further north and crossed the Sea of Okhotsk to reach Kamchatka in the early years of the 18th century. The city of Saints Peter and Paul, Petropavlovsk, was built in 1740, designed to be a springboard for imperialist ambitions in Japan, CHINA, and even INDIA. Instead, the settlements here became a launch-pad for exploration of Alaska and the northwest coast of North America. Russian occupation was brutal, sparking off a series of mass suicides among the Koryaks and Kamchadals, who preferred death to slavery, until administrators were finally sent from the imperial government to establish some sort of law and order.

By the mid-19th century, Russian interests were again looking south to China and the rich Amur Valley, so Kamchatka faded in importance. American and British whalers, however, continued to trade regularly with Russian Far East settlements. Japanese fishing fleets also came in large numbers, attracted to the vast numbers of salmon, red roe, and other fish in Kamchatka's waters. Trade with Americans and Japanese was encouraged during the 1930s (a formality, since Moscow's central authority was so far away anyway) but was sharply curtailed after World War II, when the area became one of the most completely sealed-off regions in the entire Soviet Union. One of the primary focuses during this time was the creation of geothermal

power stations, several of which are now under sharp scrutiny for environmental violations. Other resources—coal, copper, gold, iron and sulfur—are still mostly unexploited because of great distances from commercial markets, and extreme harshness of the climate. Kamchatka has formed its own separate district since 1956 (178,746 square km or 69,711 square mi), but the Koryak area to the north declared itself independent in 1990.

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## Kansas

LOCATED MIDWAY between the east and west coasts of the UNITED STATES, Kansas has a unique position as a geographic hub. Despite images to the contrary, Kansas has a unique geography as a transition between the historic farmlands of the east and the open range of the west. The land rises gently from 679 ft (207 m) above sea level in the southeast to 4,039 ft (1,232 m) at Mt. Sunflower in the northwest. In between, the land is interspersed with a mixture of large and gently rolling hills and soils that become progressively drier once you pass the middle of the state near Salina on the way west.

The Flint Hill region in the east and west-central part of the state represents one of the last true tall grass GRASSLANDS with its golden prairies in spring and early summer, gentle streams, free-roaming cattle, and a quietness that brings to mind images of cowboys and campfires. In the northeast, the hills are more sharply defined by a rockier terrain and are heavily wooded, a remnant of the last great glacial advance that moved across the North American landscape. From the 100th meridian westward, the land becomes drier and the hills less prominent as you approach the western boarder. Here the Great Plains dominate and a sand hill region is exposed, typifying a PHYSICAL GEOGRAPHY that is prominent from MEXICO far into CANADA. It is also representative of a time when great parts of the

continental interior of the United States were covered by ocean waters, which as much as glaciers from the ice ages has helped shape the American landscape. Kansas is bordered by MISSOURI to the east, OKLAHOMA to the south, COLORADO to the west, and NEBRASKA to the north. With a total area of 82,282 square mi (213,064 square km), the state's 2,688,418 residents live in the 15th largest of the 50 states. Kansas was the 34th state to join the United States, doing so on January 29, 1861.

Kansas's waters have played an important role in its development. Early settlers to the region found their way by following the Missouri River upstream from St. Louis to the point where the river is joined by the Kansas or Kaw River and makes a major turn to the north. By the 1820s, this convenient location had become an important warehousing and distribution center as early Kansas City took form in providing support for the Santa Fe and Oregon trails. Other major waterways that continue to serve the state are the Kaw, Republican, and Smoky Hill rivers in the north, and the Arkansas, which makes a somewhat east-west transect of the southern half of the state on its way from the ROCKY MOUNTAINS to the Gulf of Mexico. Kansas is also home to one of the largest underground aquifers (the Ogallala) in the United States. Use of the waters from this aquifer has greatly expanded the agricultural potential of the drier, sandier soils of the western part of the state by allowing a shift from dryland to irrigated production practices. Once known primarily as the "wheat state," Kansas now has significant corn, soybean, and sunflower crops in addition to a thriving cattle industry.

Kansas is historically an agricultural state, ranking third behind TEXAS and MONTANA in total agricultural acreage. While Kansas is the nation's top wheat grower and also the leading producer of grain sorghum and corn, manufacturing and service industries have recently surpassed agriculture as the major income producers. The two leading industries are the manufacture of transportation equipment and industrial and computer machinery. Other important manufactures are petroleum and coal products and non-electrical machinery. In addition, the state is a major producer of crude petroleum and has large reserves of natural gas, helium and salt. Cattle and calves represent the single most valuable agricultural product, and the Kansas City stockyards are among the nation's largest.

Economically, the state can be divided into several distinct production zones. In the wooded northeast, the manufacturing of a variety of products, including auto-

mobiles in the Kansas City region, dominates. The southeast has a strong aircraft manufacturing sector centered in Wichita, as well as railroad shops, flour mills, meatpacking plants, grain elevators, and oil fields. Coal production along the eastern border corridor with Missouri has long helped serve the electric energy needs within the region. The southwestern part of the state around Garden City is home to several major meatpacking firms in addition to feedlot operations and natural gas and helium production facilities. The central, northwest, and north-central portions of the state retain the economic stability of what has come to be called the “heartland,” with large-scale scientifically managed farming operations.

The state’s main population centers include the Kansas portion of metropolitan Kansas City in the northeast; Wichita, the state’s largest city in south central part of the state; Topeka, the state capital; and Lawrence in the northeast.

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## Karachi

AFTER PAKISTAN’S independence, Karachi was the national capital for 13 years (1947–60). In 2004, it was the capital of the Province of Sind. With a population of a little over 11 million, Karachi is the 16th largest metropolis of the world. Karachi has a semi-desert climate with a summer mean temperature of 80 degrees F (26.7 degrees C). Situated adjacent to the INDUS RIVER delta, it opens up to the ARABIAN SEA; it is not only the largest city of the country but also its largest port. During the British colonial times, it was a medium-sized city; the 1941 population was 435,000. After the partition of colonial India into INDIA and PAKISTAN in 1947, there was a huge migration of Urdu and Gujarati speaking Muslims from India to Karachi, and

an exodus of Sindhi- and Gujarati-speaking Hindus from Karachi to India. The Indian migrants in Karachi are called Muhajirs. Such population exchanges made Karachi linguistically heterogeneous, as 66 percent of the city dwellers became Urdu speakers and native Sindhi citizens turned into a minority community, and homogeneous in terms of religion, with over 95 percent Islamic believers.

Moreover, the attraction of Karachi as a thriving industrial city pulled many migrants from the Punjab province of Pakistan, who were also Muslims; they were bilingual, as they spoke both Punjabi and Urdu. During the Afghan War of the 1980s, when Soviets virtually occupied Afghanistan, a large number of Pushtu-speaking Pathans (Pashtuns) came as refugees, creating additional diversity. Many of Pushtu-speaking Pathans returned to their country after 2001. No other South Asian metropolis has so large a nonnative population base as Karachi. In the 1960s, only 16 percent of Karachi’s population was born in the city.

Karachi’s industries, mostly in large, planned industrial estates at the western periphery of the city, include cotton, engineering, leather, and consumer goods. Since the 1980s, development of heavy industries has been prohibited in the city proper because of increased level of air pollution. The center of Karachi has bazaar-type commercial establishments with high density of population. To the east are Civil Lines and the planned military cantonment dating back to 19th-century colonial times. New rich and upper-middle-class housing is located adjacent to the Civil Lines. The poor live in the central area as well as toward the west near their workplaces.

Ethnic and linguistic rivalry, associated with fertile ground for al Qaeda recruitment and availability of U.S. supplied arms during the 1980s Afghan War, have turned Karachi into a playground of unruly militants. Muhajirs are divided into three warring groups: Muttahinda Qaumi Movement, Muhajir Quami Movement, and Basic Association of Citizens of Karachi. They operate as gangs from their own exclusive territorial strongholds. Apart from the law and order situation, Karachi’s problems include a severe shortage of drinking water, very high growth rate of population because of migration, and proliferation of slum settlements (*katchi abadi*).

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## karst

KARST IS A TERRAIN characterized by sinkholes, caves, and disappearing streams that have been created by chemical weathering in thick carbonate bedrock. Karst is named for the Krs Plateau along the ADRIATIC SEA and comes from an old Slavic word meaning "barren land."

In the karst hydrologic cycle, moving water slowly dissolves away the limestone at and below the surface of the Earth, creating bumpy surface features and sub-surface cavern systems. Landscapes generally appear pockmarked and gently rolling. Sinkholes or surface depressions are created when the roof of an underground cavity becomes thin and collapses under the weight of overlying beds. Sinkholes are visible at the surface and usually resemble small lakes and ponds. Some of them are steep-sided and deep, while others are minor dents in the land and relatively shallow. Some sinkholes fill with soil eroded from nearby slopes and are barely distinguishable. As sinkholes grow in size and abundance, cavern ceilings often collapse, thus exposing broad, flat-floored valleys.

Hydrogeologists cannot yet predict the location and timing of sinkhole creation. The dissolution of underground limestone creates honeycombs of caves columned with stalactites and stalagmites, generally circuitous and extending for miles. Streams run underground over long distances and are usually periodic at the surface, gushing up only in the event of heavy rains. Some cave patterns are dendritic or treelike; others have intersecting joints or meander like streams. Springs are a common feature in the karst areas, and because of their cool and constant temperatures, they have unique plant and animal life such as watercress, flatworms, and snails. Karst regions typically have caves in all stages of evolution, from water-filled holes to mature caves with large passageways and sporadic water flow. In order for karst to appear, limestone formations must contain at least 80 percent calcium carbonate, be aerated, and have joints for water to flow,

Karst regions are found throughout the world and cover about 15 percent of the Earth's land area. The



*A coastal karst terrain on Navassa Island exemplifies the alien landscape typical of the landform.*

most notable examples are the Mammoth Cave region of KENTUCKY; Dalmatia, along the ADRIATIC SEA; the haystack hills of CUBA, PUERTO RICO, southern CHINA; JAPAN; the Yucatan Peninsula of MEXICO; the MISSOURI Ozarks; INDIANA; NEW MEXICO; and northern and central FLORIDA. In Florida, karst is associated with the largest artesian system in North America. Artesian springs abound and are often the source of rivers. Silver Springs, Florida, discharges nearly half a billion gallons of water daily, the largest known artesian outflow in the world. Some parts of the Florida artesian system discharge on the sea floor at considerable distances from shore. With a consistently high water table, the caverns of Florida karst are typically filled with water and the sinkholes are lakes. In fact, there are so many sinkholes in central Florida that the region is called "the lake district."

In Missouri, "the cave state," the Division of Geology and Land Survey has counted more than 5,000 caves. Most of them are dolomite or limestone and some of them run more than 15 miles. Mammoth Cave

in Kentucky is the longest cave in the world (350 mi or 560 km); almost 40 percent of Kentucky has karst features. Tower karst in China is composed of resistant blocks of rock that extend up 660 ft (200 m).

Caves have been utilized by human beings since ancient times, some as human burial places, others as hiding places and storage sites for furs, metals, alcohol, and food supplies. More than two dozen caves underlay the city of St. Louis, and historically many of them were used as underground breweries, saloons, beer gardens, and storage areas. Today karst topography poses serious hazards for construction and settlement. Chasms can suddenly appear and swallow entire houses and sections of highway.

Because the bedrock is unstable and cavernous, homes in karst regions are generally built without basements, and highways and cemeteries must be sited with care. Subsidence along a line of sinkholes and cavern collapse can quickly render an area off limits to human development. Sinkholes become repositories for everything from kitchen trash to bulldozers and thus become serious and elusive environmental challenges. Sinkhole contaminants flow with the water underground and travel far afield along the labyrinth of pathways, making cleanup virtually impossible.

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## Kashmir

**KASHMIR** IS THE name given to the Vale of Kashmir, a valley situated on the Jhelum River between the Pir Panjal range and the main range of the HIMALAYAS. By extension, the name is used to refer to the Indian state of Jammu and Kashmir and to a portion of the old preindependence territory that included what is now called Northern Areas and Azad (Free) Kashmir in PAKISTAN. In addition, INDIA claims a 14,500-square-mile (37,554-square-km) section of the Tibetan plateau, "Aksai Chin," as part of the old state of Kashmir. Kashmir was also a state under British sovereignty

until 1947 when the Hindu maharaja of the largely Muslim state attempted to obtain a degree of independence for his land by not joining Hindu India or Muslim Pakistan. The delay led to disputed territory between the two powers. The Indian government claimed that the Hindu ruler of Kashmir state had signed an Instrument of Accession to India, although the original document has never been seen, nor is there any evidence to indicate that the maharaja signed the document on the day cited, as he was being driven from Srinagar to Jammu. The state fell into outside hands, once again having been under the rule of the Moghuls and the Sikhs in previous centuries. Although the United Nations agreed to the suggestion of a plebiscite to which India also agreed, no such vote has ever taken place.

India has claimed territory, the former Gilgit Agency and Baltistan, that is now under Pakistani control and known as the Northern Areas. A small portion of this agency in the extreme north and lying in the watershed draining into CHINA was deeded to China by Pakistan in 1964. At no time did Gilgit Agency come under direct Kashmir rule, because the British kept a civil and military delegation in the agency prior to independence. Because of the continuing disputes of jurisdiction of Kashmir, Pakistan has agitated for a plebiscite, which now seems remote. Armed conflict by India with China and Pakistan has resulted in small wars in 1962 with China and in 1965 and 1971 with Pakistan. A transitory border, "The Line of Control," was established but another dispute broke out in 1984 when Pakistan issued permits to tourists into territory that India claimed as Kashmir India territory. This dispute revolved around the Siachen glacier, the headwaters for the Nubra River flowing into the Shyok River, a tributary of the Indus.

This continued territorial dispute mars the attributes of Kashmir in its several guises today. Geographically, Jammu is in the Punjab lowlands and is Hindu or Sikh. The Vale of Kashmir is almost all Muslim today, the Hindu castes having left. Territorially, the largest area is Ladakh in the trans-Himalaya Tibetan plateau, where local culture is similar to that of Tibet but where there are a substantial number of Muslims, both Sunni and Shia. These people formerly conducted caravan trade across the infamous "Five Passes" route, that is, five passes over 18,000 ft (5,500 m), on the route from Leh in Ladakh to Sainju Bazaar down on the edge of the Takla Makan Desert bowl of XINJIANG province in western China. This lucrative trading route was the reason for the prosperity of old Kashmir. Its





geography created a passland, that is, a state through which passes were essential for its commercial existence. The route was dangerous with robbers from Shimshall in the Hunza area pillaging pack ponies and Bactrian camels who often died from lardug, high-altitude pulmonary edema. The hybrid Buddhist-Muslim trader community in Leh and along the trading route ensured the viability of the caravans. Between Srinagar and Leh, the Zoji pass was snowed in for six months of the year, thereby disrupting traffic. Another route from Srinagar went north over the Burzil pass down the Astor valley, over the Indus, and north to Gilgit. Because of the narrow defiles north of Gilgit and Hunza and over the crest of the Karakorum range little inter-regional trade was carried over this route. Transhumants of sheep and goats still migrate seasonally in the Pir Panjal and Himalaya mountains.

The Vale of Kashmir was once a major tourist destination, with houseboats on the Dal and Wular lakes nestling below high mountains with local products for sale. Many Indian films customarily showed Kashmir scenes. Trout fishing on the Liddar River on the Hindu pilgrimage route beyond Pahlgam was famous. Traditional woodworking, silk making, and wool products were highly sought. Agriculture is marginal, with rice, maize, peas, and beans widespread. The cultivation of saffron is a local specialty. Basic foodstuffs are imported from the Punjab. Stone fruits, cherries, peaches, apricots, and walnuts and almonds are exported to the plains of India through the Banihal tunnel, the main supply route from the Vale to India. Wildlife has suffered extreme depredation in recent years because of the prevalence of military weapons among divisive political factions. The noble sambar deer is severely depleted; ibex wild goat and urial wild sheep and blue sheep still remain in places in Ladakh, although markhor seems to have disappeared. Brown bear and Himalayan black bear now have their ranges severely curtailed. The elusive snow leopard still exists in the Markha valley in Ladakh, where a major conservation effort is under way.

In the past three decades, language has changed significantly. Kashmiri, an Indo-Aryan hill language cognate with the hill languages spoken through northern Pakistan to Pashai in Kabul Kohestan in Afghanistan, reports a decline in the number of speakers. Bazaar languages, Punjabi in the Vale of Kashmir, like Pashto in northern Pakistan and Farsi in Kabul Kohestan, have smothered regional languages in everyday usage. English schools are ubiquitous. Two villages in Ladakh sitting on the "Line of Control," Dah

and Hannu, retain pre-Islamic, pre-Buddhist cultural celebrations to this day. Nineteenth-century linguists referred to these villages, and others, as Dardic, although there is no validity to this term today. Eurocentric myths about the "Dards" being the true Aryans still surface today in Ladakh.

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## Kazakhstan

**Map Page** 1119 **Area** 1,049,155 square mi (2,717,300 square km) **Population** 16,763,795 **Capital** Astana **Highest Point** 23,084 ft (6,995 m) **Lowest Point** -436 ft (-132 m) **GDP per capita** \$6,300 **Primary Natural Resources** petroleum, natural gas, coal.



THE REPUBLIC OF Kazakhstan occupies the center of the Eurasian supercontinent, the second largest of the former Soviet republics and today the ninth-largest nation in the world. Most of its vast territory, stretching from the Caspian and Volga lowlands in the west to the ALTAI MOUNTAINS on the borders with CHINA, is flat, covered in arid semidesert or STEPPE. Its people have been nomadic herders for millennia but are now taking the lead in the development of industry, agriculture, and international trade for Central Asia.

Kazakhstan has no coastline, except for 1,174 mi (1,894 km) along the landlocked CASPIAN SEA. Its main trade corridor has therefore been across the land, connecting the commerce of its neighbors (RUSSIA, TURKMENISTAN, UZBEKISTAN, KYRGYZSTAN, and China), starting with the SILK ROAD in the Middle Ages, contin-



uing with the development of railroads in the 20th century, and once again building its transportation links with China today. The Kazakh people are a mixture of Turkic and Mongol nomadic tribes who ruled the region through interlocked, kin-based khanates until gradual annexation by the Russian Empire in the 18th century.

After a brief attempt at autonomy in the 1920s, the region became a Soviet Republic in 1936. The Soviets initiated intense agricultural and industrial development projects in the northern steppes during the 1950s, which brought numerous immigrants—Russians, Ukrainians, Germans, and others—who eventually out-numbered the native peoples. The Kazakhs declared their independence in 1991, and the population has once again shifted, through both mass emigration and a higher birthrate among ethnic Kazakhs.

### THREE REGIONS

Geographically, the country is mostly homogeneous, a great flat tableland of lowlands, plains, and plateaus. This can be broken up into three basic regions: the Volga and Caspian lowlands of the west (with the narrow, low Mugodzhar Mountains), the Turgai Plateau, and the Kazakh Steppe. The Turgai Plateau is characterized by a central depression with a chain of small lakes. Most of the area's rivers flow into these lakes, some of which evaporate and disappear completely during the dry season.

The Ulu-Tau mountains divide this area from the eastern third of the country, the Kazakh Steppe, which is mostly flat with a few scattered massifs. The primary of these elevated areas divides the watershed between the upper Irtysh River valley (whose waters flow across the West Siberian Plain all the way to the Arctic Sea) and Lake BALKASH, one of the largest lakes in the world in area, but not in volume, since it is very shallow. Lake Balkash is also very salty and has very little wildlife. South of these broad semi-desert and steppe plains are the northern edges of one of the great deserts of Central Asia, the Kyzyl Kum. Across this desert runs the other major river of Kazakhstan, the Syr Darya, which flows into the ARAL SEA. To the east and south rise the great mountain chains that divide Central Asia from China, the Altai, and Tian Shan.

Along the northern edges of Kazakhstan, several large cities were developed under the Soviet regime, the mining and industrial heart of Central Asia. Kazakhstan is a leading producer of coal, iron ore, manganese, copper, and many other minerals. It is oil and gas, however, that hold the most promise for the Kaza-

khs, with reserves estimated to put Kazakhstan into the top 10 oil producers in the world by 2015, especially around the Caspian Sea basin—the Tenghiz field ranks as one of the largest deposits in the world. Agriculture is still a major part of Kazakh economy, chiefly in grain exports and livestock.

Actively courting western investment and friendship, the Kazakhs declared their territory nuclear free in 1995, and the new national capital (Astana, moved in 1998, formerly known as Akmola, then as Tselinograd) lies inside a special economic zone with reduced trade barriers and tax incentives for investors. Russia continues to run the space center Baykonur Cosmodrome (formerly called Leninsk), but the Kazakh government is encouraging greater participation by ethnic Kazakhs.

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## Kentucky

NICKNAMED FOR the bluegrass that covers much of this U.S. state, and known for its whiskey and for the Kentucky Derby that takes place annually at Churchill Downs in Louisville, the Commonwealth of Kentucky was named for the Kentucky River, which was thought to have been named from the Iroquoian word(s) for either “meadowland” or “land of tomorrow.” Kentucky is bounded on the north by the states of ILLINOIS, INDIANA, and OHIO, on the south by TENNESSEE, on the east by VIRGINIA and WEST VIRGINIA, and on the west by MISSOURI.

The Ohio River runs along the entire northern boundary of Kentucky, and the MISSISSIPPI RIVER runs along the western boundary. The total area of Kentucky is 39,728 square mi (102,895 square km). The state ranks 36th in size and 25th in population among the 50 states. Kentucky's largest cities are Lexington, Louisville, Owensboro, Bowling Green, Covington,

Hopkinsville, Frankfurt (the capital), Henderson, Richmond, and Jeffers town.

Approximately 679 square mi (1,758 square km) of Kentucky are covered by water. In addition to the Kentucky, Mississippi, and Ohio, Kentucky's rivers include the Cumberland and the Green. Most of Kentucky's lakes were created by damming river waters, including Barkley Lake, Rough River Lake, Green River Lake, Dewey Lake, and Cumberland Lake. Kentucky has a number of significant waterfalls. The average elevation of Kentucky is 750 ft (228 m) above sea level. The highest point in the state is 4,139 ft (1,261 m) above sea level at Black Mountain, and the lowest point is 261 ft (79 m) above sea level at the Mississippi River. The state is approximately 380 mi (611 km) from east to west and approximately 140 mi (225 km) from north to south.

Kentucky's climate is temperate with annual temperatures ranging from 52 degrees F (11 degrees C) in the northeastern part of the state to 58 degrees F (14 degrees C) in the southwestern section. Temperatures throughout the year range from below freezing in the winter to warm and humid in the summer. Annual precipitation is approximately 45 in (114 cm). Winter snow averages range from 40 in (101 cm) in Kentucky's highest elevations to 25 in (63 cm) in the northeast, to 10 in (25 cm) in the southwest. Kentucky is frequently beset by storms, particularly from March to September.

The geographic area of Kentucky is varied, encompassing five distinct physiological regions: the Bluegrass Region, the Cumberland Plateau, the Western Coal Field, the Pennyroyal Region, and the Jackson Purchase Region. The north central section of Kentucky falls within the Bluegrass Region, sometimes called the Lexington Plain, which extends into the neighboring state of Ohio.

Much of the Bluegrass Region is filled with rolling meadows and low, steep sandstone hills known as knobs, which are found in the Knobs Region that forms the eastern, southern, and western sections of the Bluegrass Region. The Knobs Region separates the Bluegrass Region from the Cumberland or Mississippian Plateau. The Cumberland Plateau is part of the Appalachian Plateau, which extends along much of the eastern part of the UNITED STATES from NEW YORK to ALABAMA. In Kentucky, the area is characterized by mountains, plateaus, and valleys that are underlain with sandstone, shale, and limestone. Kentucky's Cumberland, Pine, and Black mountain ranges are located in the Cumberland Plateau. The section of the plateau

known as the Eastern Coal Fields is a mountainous area covered with forests and streams. These mountain ridges are frequently crossed by gaps such as the well-known Cumberland Gap. Much of the Daniel Boone National Forest lies at the western end of the Eastern Coal Fields.

The northwestern section of Kentucky contains the Western Coal Field, which is a hilly area that lies within the Illinois Basin, extending to the Ohio River on the north and to the Pennyroyal Region on the east, west, and south. The Western Coal Field is named for the large deposits of coal that appear throughout the area. The soil on the borders of the Ohio River is highly fertile. The Pennyroyal Region, sometimes referred to as the Pennyryle Region for the small herb that grows in the area or, alternately, as the Highland Rim, covers a stretch of land between the southern border of Kentucky in the Appalachian Plateau to Kentucky Lake. The southern section of the Pennyroyal Region is made up of flat lands interspersed with occasional rolling hills, while the northern section is comprised mostly of rocky ridges containing numerous underground caves and tunnels. The best known of the caves is Mammoth Cave. A treeless area within the center of the Pennyroyal Region is known as The Barrens.

The Jackson Purchase Region is located at Kentucky's western tip and is part of the Gulf Plains Region, which extends from the Gulf of Mexico to Illinois. The Jackson Purchase Region stretches to the Kentucky Lake in the east, to Illinois in the north, and to the Mississippi River in the west. Low hills and flooded plains make up the land in the Jackson Purchase Region. The Madrid Fault is located in this area. When earthquakes hit the area in 1811 and 1812, the Mississippi River began to flow backward, creating Reelfoot Lake.

Approximately 40 percent of Kentucky is forested. The coffee tree is the state tree. Kentucky hardwoods include oak, beech, hickory, maple, and walnut. Softwoods include cypress, hemlock, cedar, and pine. Flowering shrubs include buckeye, dogwood, laurel, azalea, rhododendron, redbud, blueberry, pennyroyal, and goldenrod (the state flower).

Earlier in Kentucky's history, bison and elk roamed the forest, but now the woods are filled with fox, groundhog, muskrat, opossum, rabbit, raccoon, squirrel, and deer. In addition to the cardinal, which is the state bird, Kentucky is home to the eagle, egret, mockingbird, yellow-billed sapsucker, crow, kingfisher, and woodpecker. Migratory birds are also frequently seen

in the area. Kentucky has four state forests and 59 state parks.

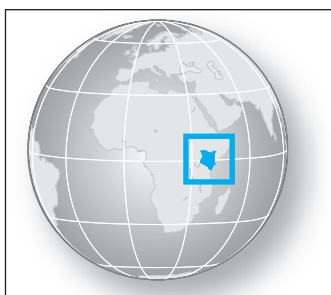
Agriculture dominated Kentucky's economy until the middle of the 20th century when services and manufacturing gained prevalence. Tobacco, hay, corn, soybeans, wheat, fruit, dairy, and livestock are the major products produced by Kentucky farmers. Industries include motor vehicles (the state's largest industry), health services, furniture, aluminum ware, brooms, apparel, lumber products, machinery, textiles, and iron and steel products. Kentucky's most important mineral resources are bituminous coal, petroleum, natural gas, stone, sand and gravel, clay, fluorspar, gemstone, limestone, lead, zinc, and fluorite. Kentucky's coal mines provide 85 percent of the state's mineral income.

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## Kenya

**Map Page** 1114 **Area** 224,900 square mi (582,488 square km) **Capital** Nairobi **Population** 31,639,091 **Highest Point** 17,058 ft (5,199 m) **Lowest Point** 0 m **GDP per capita** \$1,100 **Primary Natural Resources** coffee, tea, corn, vegetables, livestock.



KENYA, WHICH LIES astride the equator on the eastern coast of Africa, is bordered in the north by SUDAN and ETHIOPIA, in the east by SOMALIA, on the southeast by the INDIAN OCEAN, on the southwest by TANZANIA and to the west by Lake Victoria and UGANDA.

The country is notable for its' geographical variety. While most people immediately think of African wildlife and great expanses of GRASSLAND, the land is made up of several distinctive geographical regions. The first is a narrow, low-lying, fertile coastal strip along the shores of the Indian Ocean that is fringed with coral reefs and islands. A series of low hills sepa-

rates the coastal region from the vast bush-covered plains of the eastern plateau forelands, which sprawl between the central highlands to the west and the coastal strip on the east and slope gently toward the sea.

In the southwestern corner of the country is the Lake Victoria basin, which extends eastward from the lake to the central rift highlands, in which about 85 percent of the population and the majority of economic enterprise are concentrated. The central rift highlands run from north to south down the western half of Kenya and are split by the famous Rift Valley into two sections, the Mau Escarpment on the west and the Aberdare Range and accompanying highlands on the east. The Mau Escarpment in the west rises above 9,000 ft (2,740 m) and stretches for more than 200 mi (320 km) northward from the Tanzanian border to the west-central border with Uganda.

The Aberdare Range to the east, which forms the eastern border of the Rift Valley, rises to nearly 10,000 ft (3,050 m). In the high plateau area, known as the Kenya Highlands, lie Mt. Kenya 17,058 ft (5,200 m), Mt. Elgon 14,176 ft (4,322m), and the Aberdare Range rising to over 13,000 ft (3,963 m). The plateau is bisected from north to south by the Rift Valley. The Great Africa Rift Valleys runs from North to South through the whole of Kenya. The Kenyan Rift Valley is a section of a 3,700 mi (6,000 km) rift system that stretches from the Dead Sea in the MIDDLE EAST, south through the RED SEA, Ethiopia, Kenya, Tanzania, MALAWI, and into MOZAMBIQUE. The whole area contains several lakes, extinct volcanoes, and numerous small game parks. The scenery in the Rift Valley is breathtaking, particularly at the viewing points just north of Limuru and Naivasha or from the top of the Mau escarpment. In the south, the valley narrows and deepens with walled escarpments rising 2,000 to 3,050 ft (610 to 930 m) above the valley floor, while in the west, the plateau descends to the plains that border Lake Victoria.

A network of small, seasonal rivers and streams drains most of the Kenyan landscape. Kenya's most important river, the Tana, rises in the central highlands and drains some 16,300 square mi (42,200 square km), roughly 7 percent of the country's total land area, before flowing into the Indian Ocean. Northern Kenya receives little rainfall, but regions in the southern part of the country are plentifully watered. Kenya has two rainy seasons: the long rains from late March to May and the short rains from October to December. Evergreen forests can be found in the highlands along with

wide expanses of bamboo grass. East and west of the highlands, the vegetation gives way to low trees that are casually scattered throughout a predominantly grassy landscape. Semidesert conditions exist below 3,000 ft (915 m) in the north, with thick expanses of thornbush interspersed with massive baobabs trees. In the coastal belt, dense, high bush alternates with limited areas of forest.

Kenya is noted for its wildlife, safaris, and much of our image of Africa. Game and national parks, such as the Masai Mara National Reserve and the Ambosili National Park, are filled with lions, leopards, wild dogs, elephants, buffaloes, rhinoceroses, zebras, antelopes, gazelles, hippopotamuses, and crocodiles. Equally famous, but not a part of Kenya, are the Serengeti National Park and Mt. KILIMANJARO, both of which lie just across the border in Tanzania. Only about 4 percent of the land is arable and nearly all of this is cropped, mainly with corn and other grains.

Kenya became an independent country in 1963. Jomo Kenyatta, a member of the Kenya African National Union (KANU), became the country's first president on December 12, 1964. Kenya soon became a one-party state, after the voluntarily dissolving of the Kenya African Democratic Union (KADU).

After Kenyatta's death in 1978, Vice President Daniel arap Moi became the interim president. Under Moi's presidency, political oppression continued with the outlawing of political activities. Thus, many aspiring politicians and political parties went underground for many years. Sensing an opportune time because of resentment of the government in the 1990s, many of the underground parties emerged to challenge KANU. Finally in 2002, a coalition of opposition parties ended the 24-year presidency of arap Moi. Mwai Kibaki became the country's third president.

In 1998, terrorists bombed the American Embassy in Nairobi. Many people, particularly Kenyans, were killed in the horrific violence. The incident further damaged the Kenyan struggling tourism industry. A major challenge to Kenya's stability is population growth. With so many people being added to the total population, there will be severe pressure on land, and subsequent intensity in the rural-urban migration phenomenon.

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## Khartoum

KHARTOUM IS THE capital city and administrative region of the Republic of the SUDAN, located at the confluence of the Blue and White NILE rivers. Khartoum is the second-largest city in North Africa, with an estimated population of 2.5 million in the city proper, and up to 7 million in the Greater Khartoum district, which includes Khartoum General, Khartoum North, and Omdurman, each city linked by bridges. Khartoum has a thriving market in cotton products, woven textiles, and knitwear and is a railroad hub that facilitates the transportation of a number of goods, including glass, tile, foodstuffs, gum, and oil. Khartoum has an international airport and two major universities.

Khartoum was officially founded in 1821 as an Egyptian army camp and the base of operations for the Ottoman conquest of the Sudan. Muhammad Ali, the Turkish pasha of Egypt, conquered the portion of the Sudan originally controlled by the Funj Empire in order to take advantage of the region's vast human and economic resources and made Khartoum a depot for the Arab slave trade in Africa as well as a major mercantile center. Khartoum remained under Egyptian military occupation until 1881, when Muhammad Ahmad, the self-proclaimed Mahdi (divinely guided seeker of justice) of the Sudanese people, staged a rebellion that resulted in the city's liberation.

Ahmad and his followers, the Madhists, took advantage of Egypt's instability in the wake of the British conquest of Northeast Africa but were themselves soon involved in it directly as a British company under General Charles Gordon, who arrived to take the city in 1884. He arrived at Khartoum on February 18, with orders to evacuate a small force of Egyptian soldiers trapped there, but decided to mount an offensive against the Madhist rebels instead, believing that he had the resources to defend the city. Gordon's tactical error led to a 10-month siege on his company that eventually resulted in his death on January 26, 1885, after the Madhists broke his defenses, destroying much of the city in the process. Khartoum was eventually retaken by the British under Field Marshal Herbert



Kitchener in 1898, which marked the advent of joint British and Egyptian colonial rule that lasted until Sudan gained its independence in 1956.

The greater Khartoum area has experienced its troubles internally and with the world postindependence. It is houses one of the largest refugee populations in the world, largely the result of civil wars in the region. Oil interests have done little to help the city's growing problems, especially escalating poverty resulting from overpopulation and lack of resources. Slums are a major problem in Khartoum. In 1998, a pharmaceutical company in Khartoum was bombed by the UNITED STATES, as it was believed to have been a chemical weapons factory for terrorist groups. Khartoum has been regarded as a center for potential terrorist activity, though no direct evidence has been found directly linking the city's government with any terrorist organization.

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## Kilimanjaro, Mount

A MAJESTIC ROCKY GIANT, Mount Kilimanjaro is crowned by an icecap, impressively dominating the scenery. Mount Kilimanjaro towers above the Masai Steppe or the Great Rift Valley, which is believed to be the site of the origin of humankind. Pictures that shaped our imagination of East Africa are firmly connected to Kilimanjaro. The highest mountain of Africa is a volcanic massif situated in the territory of north-eastern TANZANIA. The mountain consists of lava-dominated shield volcanoes and has three main volcanic centers, named Shira, Kibo, and Mawenzi. The highest point of the Kilimanjaro at the crater Kibo is called Uhuru Peak. At 19,340 ft (5,895 m) above sea level, it is Africa's highest elevation point. Mawenzi (east of Kibo) rises to 16,896 ft (5,149 m), and Shira (west of Kibo) to 13,000 ft (3,962 m).

Kilimanjaro is a very young volcanic massif: it started to grow less than 1 million years ago and ceased to grow about 450,000 to 300,000 years ago. Volcanic activity subsequently became sporadic, and



Tanzania's Mount Kilimanjaro, at 19,340 ft (5,895 m) above sea level, is Africa's highest elevation point.

today the inner crater of the Kibo shows only residual activity. The last blow of ash from the Kibo could be witnessed probably about 200 years ago. The volcanoes of the Kilimanjaro are part of a chain of Cenozoic volcanoes in East Africa. The major factors influencing the volcanic activity of this area are the PLATE TECTONICS of the East African Rift System (EARS), which marks the lines along which the eastern subplate is separating from western subplate.

Kilimanjaro rises from 2,297 ft (700 m) above sea level to its highest peak in a relatively confined space, which stretches from east to west about 53 mi (85 km) and from north to south about 50 mi (80 km). It is thus an ideal example of the geomorphologic and ecological change in different altitudes and is characterized by a distinctive differentiation of the natural area. Five major vegetation zones can be found at Kilimanjaro: the lower slopes; the tropical mist- and mountain-forest zone between 5,905 and 9,187 ft (1,800 to 2,800 m); the low alpine zone with heath and moorland; the highland desert; and the summit. Fertile volcanic soils and good climatic conditions allow a variety of crops to grow in the Kilimanjaro region. This resulted in manifold and diversified pre- and early-colonial agricultural activities of the Chagga, the native people who inhabit the region. The colonial and postcolonial agriculture focused increasingly on the industrialized production of the cash crops banana and coffee. The consequences subsequently led to a fundamental economical and structural change, extensive clearings and destruction of forest and pasture land, increasing erosion, and high population growth.

Another factor with major economic and ecological impact for the Kilimanjaro region is mountain tourism. Hans Meyer, a German colonial geographer and rich heir of a huge Leipzig publishing house, first ascended the Kibo crater in 1889 and called it Kaiser-Wilhelm-Spitze (since 1962, Uhuru Peak). Since this first ascent of Kilimanjaro, more and more mountaineers have been attracted by the mountain.

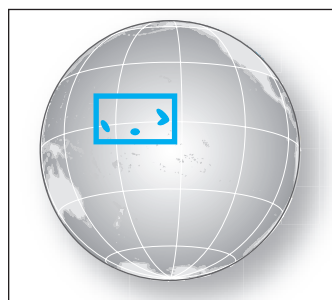
Each year, almost 20,000 tourists try to ascend the summit. Added to the high number of local guides and porters who are hired to succeed in this endeavor, a yearly total of more than 70,000 people climb up the mountain through ecologically sensitive terrain. Negative side effects of the economic benefits are the inevitable damages to the environment, although since the 1970s the main area of the Kilimanjaro enjoys the status of a national park. Moreover, for reasons of global warming, the impressive ice sheets and glaciers of the mountain (only 10 years ago, glaciers covered most of its summit) have been receding rapidly. More than 80 percent of the icecap that crowned the mountain when it was first thoroughly surveyed in 1912 is now gone. If recession continues at the present rate, it is projected that the glaciers of the Kilimanjaro, the last glaciers of Africa, are in serious threat of vanishing in the next 15 years.

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## Kiribati

**Map Page** 1128 **Area** 313 square mi (811 square km)  
**Population** 98,549 (2004)  
**Capital** Bairiki **Highest Point** Banaba Island 243 ft (81 m)  
**Lowest Point** 0 m **GDP per capita** \$800 **Primary Natural Resources** phosphate (depleted by 1979), copra.



THE REPUBLIC OF Kiribati consists of 33 atolls straddling the equator and the INTERNATIONAL DATE LINE. The country is composed of the Gilbert Islands, the Phoenix Islands, and the Line Islands. The Gilbert Islands are made up of 17 atolls, are home to the majority of the population, include the capital Bairiki, and harbor the once phosphorous-rich island of Banaba. The Phoenix Islands are composed of 8 atolls, none of which has a permanent population. These islands were part of a government relocation program in the 1930s and 1940s as an answer to overcrowding on other islands, yet by 1952 the plan was considered a failure. Resurrection of a similar plan began in 1995 and may lead to future permanent settlements. The Line Islands, of which only three of the eight are inhabited, include the largest of the islands, Kiritimati (CHRISTMAS ISLAND).

Kiritimati is the largest atoll in the world and encompasses approximately half of the Kiribati land-mass. A remote country, Kiribati is primarily composed of atolls with little variation in topography. The reefs, flats, and lagoons surrounding the atolls are natural attractions for the growing tourism industry. Global warming issues and the resulting rising sea levels have become a concern for the nation, as most of the country is at sea level. The climate is tropical with the potential for typhoons occurring primarily from November to March.

The majority of the population is of Micronesian ancestry with many of the ancestors originating from Tonga and Fiji. English is the official language, while I-Kiribati is widely spoken. In 1892, the British proclaimed the island group a British protectorate. From 1963 until 1979, the islanders were given an advisory position in the political decisions of the nation and gained final independence from the British on July 12, 1979. With the independence came the name change from the Gilbert Islands to Kiribati, which is the local translation for the Gilberts.

This sovereign democratic republic is resided over by a president, composed of three administrative units that are split into six districts and 21 island councils, and holds a parliament consisting of 42 representatives. Local affairs are handled by local councils. Prior to 1995, the islands were split by the international date line (180 degrees longitude), but in a unilateral move, Kiribati moved the international date line so the entire country could share the same time zone.

The economy is presently based on copra and fish exports, the granting of fishing rights to foreigners, the remittance of income from overseas workers, and in-

ternational aid. Tourism has become a major export earner bringing in approximately one-fifth of the GDP. The local currency is the Australian dollar.

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## Kola Peninsula

THE KOLA PENINSULA IS one of RUSSIA's regions of great contrast: at once an area of stark natural beauty and of severe ecological danger; rich in minerals, but one of Russia's poorest regions; and an area that is both closely linked to the concerns of Western Europe and strictly isolated from the outside world. The peninsula is the westernmost of Russia's numerous peninsulas that jut out into its Arctic seas and has provided strategic sheltered harbors for Russia's northern fleets since the 18th century.

Geographically, the Kola Peninsula forms the heel of the Scandinavian landmass, pointing in the opposite direction from the other three Scandinavian projections that form NORWAY, SWEDEN, and FINLAND. The peninsula covers roughly 50,000 square mi (128,000 square km), separating the White Sea from the much larger Barents Sea to the north. Its coasts on these two seas differ sharply: along the White Sea and its tributary, Kandalaksha Bay, the coast is low and smooth; the coast along the Barents Sea, called the Murman Coast, is mountainous and heavily indented. These coastal mountains form the easternmost extension of the Scandinavian ranges that form the backbone between Norway and Sweden.

The center of the peninsula is a granite and gneiss plateau, with several large lakes, and is covered with tundra in the north and forests in the south. The plateau rises to form some moderate peaks, the highest reaching 3,930 ft (1,191 m). This mountainous region is rich in minerals. Several large rivers drain the peninsula to the north or south, including the Tuloma and the Kola. The Kola River connects the north coast and the region's chief city of Murmansk to the White Sea via Lake Imandra and a short canal. This passage allows ships from Russia's main northern port,

Arkhangelsk, on the White Sea, to reach the Murman Coast, one of the few Arctic coasts to remain unfrozen throughout the year.

Because these waters offer Russia's only year-round access to the ATLANTIC OCEAN, it has served as home to Russia's Northern Fleet since the 19th century. Murmansk was the site of a 1918 Allied troop landing and an important base in World War II. It then became a major center for the Soviet Union's nuclear submarine program. The numerous fjords between Murmansk and the Norwegian border (less than 60 mi or 100 km away) are stocked with naval and air bases, and have thus provided a source of heightened tensions with NORTH ATLANTIC TREATY ORGANIZATION (NATO) member Norway. NATO maintains numerous early warning systems on its side of the border, keeping an eye on the stocks of nuclear weapons kept on the Kola Peninsula since the 1950s.

The decay of Soviet power and the collapse of the Soviet Union have left behind about 155 nuclear submarines in the fjords of the Kola Peninsula, about half of which are unfit for use. Most of these are even unfit to be moved or dismantled, creating one of the world's largest nuclear waste problems. It is estimated that roughly two-thirds of the world's nuclear waste has been dumped off the peninsula, not counting that which is sitting in rickety ships near Murmansk. The nearby Kola Nuclear Power Station provides about 60 percent of the region's power, but has been declared one of the world's least safe reactors, having come close to a meltdown as recently as 1993.

The Russian government continues to restrict travel to and from this region, but its heavily impoverished population looks to Norway and Finland for aid rather than to Moscow. The western part of the peninsula forms part of Lapland, the homeland of the semi-nomadic Saami people that stretches across northern Norway, Sweden, and Finland. The Saami (or Lapps) live in the southeastern parts of the peninsula, while areas in the west are populated by Karelians, close kin to Finns. The languages of both Saami and Karelians are related to other Uralic languages, whose people live elsewhere in northern Russia.

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## Kolkata (Calcutta)

CALCUTTA, RECENTLY renamed Kolkata after its original village site of Kolikata and an on-site temple of goddess Kali, was founded by Job Charnock in 1690 on behalf of the British East India Company. The same location in northwestern INDIA was also a Portuguese and Dutch encampment site during the mid-17th century. It is, however the British encampment that started the impetus to develop the area as a trading center that eventually formed the core of a huge Calcutta metropolis leading to the evolution of a 50-mi- (80-km-) long linear conurbation (continuous urban agglomeration) along the Hughly (Hooghly) river.

Calcutta was the capital of British India (1757–1911) and thereafter it was relegated to the capital of the undivided Bengal Province. It has been the capital of the state of West Bengal since 1947. The Calcutta Metropolitan District was formed in 1961 as a planning unit for the entire conurbation. It consists of over 500 administrative units, including the two largest cities: corporations of Kolkata and its twin city of Haora (Hawrah).

Only 1 degree south of TROPIC OF CANCER, Kolkata falls in the monsoon climatic regime with most of its annual average rainfall of 64 in (162 cm) falling in the four-month period of June through September. Its January temperature average is 67 degrees F (19 degrees C), while July averages 85 degrees F (29 degrees C).

The British established a port, Fort Williams, and an initial water transport network to connect the city with an extensive HINTERLAND that contained the richest agricultural and mineral resource region of India. An extensive railroad network was developed in 1850s. Using the hinterland, Calcutta became the primary manufacturing center of India specializing in jute textiles, paper mills, heavy engineering, and rubber. By 1921, 35 percent of India's industrial workers were based in Calcutta.

Calcutta's economy stagnated in the 1970s because of the antipathy of both domestic and foreign investors in the face of labor union agitation and the Marxist West Bengal state government's anti-capitalist rhetoric. However, Calcutta was the pacesetter for the country for political, educational, and economic leadership. In recent years, Calcutta's importance has been displaced by MUMBAI, the population of which in 2000 was 16 million, in comparison to Calcutta's 13 million.

Nonetheless, Calcutta remains the second-largest metropolis of India; its world rank stands at seventh. The City of Calcutta, the main hub of the metropolis,

has one of the highest densities of population, over 62,000 people per square mi (24,000 per square km); one out of every three lives in slums; and the rich/poor contrast in housing is very vivid. Hindus constitute 83 percent of city population and Muslims make up 14 percent. The remaining 3 percent are Christians, Jains, and Sikhs. The city has high linguistic diversity.

The port of Calcutta was the leading export and import center of the country during the 19th and most of the 20th century. It has lost its position to Mumbai. Calcutta is the home of the Calcutta (1857) and Jadavpur (1955) universities. Four Nobel laureates are associated with the city. Rabindranath Tagore had his home here; Mother Teresa did social work and lived here; C.B. Raman worked and researched here; Amartya Sen studied, taught, researched, and lived here, too.

Kolkata, jammed with a combination of vehicles, automobiles, buses, trains, hand-pulled carts, and thousands of pedestrians, introduced a 10.2-mile (16.4-km) long subway system in 1984. The subway, which is being extended farther south and north, carries 25 percent of the commuters.

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## Kopet Mountains

THE SMALL RANGE of mountains that forms the northern boundary of IRAN with TURKMENISTAN is known as the Kopet Dag, or Kopet Mountains (Köpetdag in Turkmen). The range stretches for 400 mi (645 km), from a point near the CASPIAN SEA to the Harirud River in the east, which flows from northwestern AFGHANISTAN to a desert delta in southeastern Turkmenistan (where it is called the Tejen River).

The highest point in the range is the Kuh-e Quchan (10,466 ft or 3,191 m), in the southern part of the range in Iran. The highest point in the northern range,



which forms the border between the two countries, is Mount Shahshah (9,600 ft or 2,912 m), which looms over the city of Ashgabat to the north.

### POPULATION GEOGRAPHY

Most of the population of Turkmenistan is clustered in towns and cities in the foothills of the Kopet Dag, including Ashgabat, its largest city and capital. The northern and southern ranges are divided by the valley of the Atrak River (entirely in Iran, until it forms the border west of the Kopet Dag ranges) and the largest city of the Iranian province of Khorasan, Mashhad. Many of the local inhabitants are semi-nomadic sheepherders, while others cultivate the region's fruit specialties in the rich LOESS foothills and the mountain gorges: pomegranates, plums, figs, almonds, walnuts and pistachios, plus plants known for centuries for their medical properties, aromas, and dyes. This cultivation is aided by the fact that the mountains receive more rain than any other part of Turkmenistan.

The isolation of these mountains by deserts on both sides has produced a large variety of flora and fauna that are found nowhere else, a fact that has led the local Turkmen government to create the Syunt-Hasardag Nature Reserve—over 74,000 acres (30,000 hectares)—in the southwest portion of the range. The reserve is home to the region's most famous wildlife, its hunting birds, including the golden eagle, black griffin, and desert kestrel. Other animals include leopards, boars and desert hyenas.

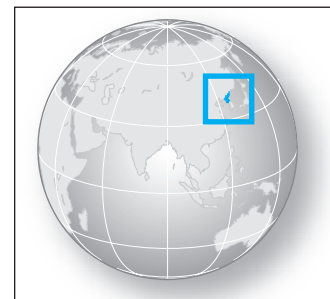
The mountains are tectonically active and frequently prone to earthquakes—the most devastating in recent history was in 1948, which completely destroyed Ashgabat. The mountains have served as a barrier for various empires centered on the Iranian plateau from invasions from the north but also as a meeting point between Central and South Asian civilizations, as the terminus (end point) of the Great SILK ROAD from CHINA to Persia.

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## Korea, North

**Map Page** 1120 **Area** 46,541 square mi (120,540 square km) **Population** 22,466,481 **Capital** P'yongyang **Highest Point** 9,055 ft (2,744 m) **Lowest Point** 0 m **GDP per capita** \$1,000 **Primary Natural Resources** coal, lead, tungsten, zinc, graphite.



THE DEMOCRATIC People's Republic of Korea, North Korea, is one of the world's most politically isolated countries. Separated from its sister nation (South KOREA) to the south since 1953, the Democratic People's Republic holds on to its Cold War ideologies long after its chief sponsors have either collapsed (the Soviet Union) or turned toward liberalized economy and better relations with the West (such as CHINA). Less populated and less developed economically than the south even before the split, North Korea is almost completely unable to feed its population because of extreme economic centralization and international blockades.

North Korea occupies the northern portion of the Korean peninsula, roughly from the 38th parallel (38 degrees north latitude, the Demarcation Line of July 27, 1953) to the border with Manchuria (China) and SIBERIA (RUSSIA). Its is bordered on the east and west by the Sea of Japan and the Yellow Sea. Most of its northern border is with China, with only 11.8 mi (19 km) bordering Russia, in the far northeastern corner. The southern border with the Republic of Korea (South Korea) is 151 mi (248 km) long, along the demilitarized zone (the DMZ), still the area of the world with the highest concentration of permanent military presence, with North Korea's 1.1 million-person army (the world's fifth largest) facing off against 600,000 South Korean troops and a sizable American military force.

The terrain is mostly hilly, with higher mountains in the interior, separated by deep, narrow valleys. There are wider coastal plains in the west, in which is located the country's only major city, P'yongyang, and its port city, Namp'o.

The mountains of North Korea are generally higher than in the south—as a result, most of the best farmland is in the south (only about one-sixth of the land in the north is suitable), while the north is richer in timber and minerals (coal, iron, copper, zinc, and other ingredients for heavy industry). The mountain ranges that run the length of the Korean peninsula

from north to south are mostly along the eastern edge of the country, with the terrain sloping gradually toward the west. The eastern coast is thus generally more steep, while the west coast has more coastal indentations and small islands (though in no way comparable to the thousands in the south). The central range for the northern end of the peninsula is called the Nangnim Range.

The highest mountains, however, are further to the northeast, including Paektu-san (Korea's highest), on the border with China, from which emanate the two main rivers in the north that form most of the border with China, the Yalu River, flowing west into the Korea Bay and into the Yellow Sea, and the Tumen River, east to the Sea of Japan, its mouth only 80 mi (129 km) from Vladivostok, Russia's major city in the Far East. Both of these rivers are navigable for a considerable distance, and both provide China and North Korea with hydroelectric power. Many of the mountains in this far northeastern corner are extinct volcanoes.

Further south, North Korean territory includes the northernmost end of the Taebaek Range, mountains of medium height that hug the eastern coast, including one of the best known mountains in all of Korea, the Kungang-san (Diamond Mountain), with its "12,000 peaks," famous scenery, spring foliage, and ancient legends about odd-shaped rocks and ravines. The Taedong River, flowing through the center of P'yongyang, is not the longest in North Korea, but it is the major transport river from the interior, past the capital and into the Korea Bay. The capital is the only city with over a million inhabitants in the north (versus six in South Korea).

Though most of the cultural and political centers in Korean history have been in the southern end of the peninsula, P'yongyang was the center of the Goryeo kingdom (the origin of the name Korea), dominating this region and much of Manchuria before the seventh century. The North prefers to use the name of Korea's former ruling dynasty, Joseon, or Choson, with more ties to these northern kingdoms, rather than the name preferred by the South, Han'guk. The Choson ruled a united peninsula until the Japanese conquest in 1910.

After 1945, Korea was divided into spheres of influence by the UNITED STATES and the Soviet Union at the 38th parallel. The Soviets refused to submit to United Nations elections to decide on the form of government, so a republic was set up in the south in 1948, followed a few weeks later by the north. War from 1950 to 1953 effected little change in the nation's di-

vided status but caused a massive depopulation of the north when nearly 1 million refugees fled south.

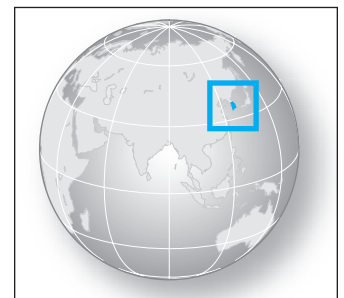
Political and economic mismanagement for the past 50 years has driven the country's industries into the ground: official government estimates for famines between 1995 and 1998 claim the loss of over 200,000 lives, while international groups claim much higher figures, around 1.5 million. The population has shifted dramatically from 20 percent urban in 1953 to 60 percent in 1987. Reunification talks have become a possibility only in the last few years, with the first meeting between the two presidents in 2000. Korean athletes marched together for the first time at the Sydney Olympic Games in 2000, and limited border crossings have begun, allowing families to visit relatives they have not seen in over 50 years.

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## Korea, South

**Map Page** 1120 **Area** 38,294 square mi (98,190 square km) **Population** 48,289,037 **Capital** Seoul **Highest Point** 6,435 ft (1,950 m) **Lowest Point** 0 m **GDP per capita** \$19,400 **Primary Natural Resources** coal, tungsten, lead, hydropower potential.



AN ECONOMIC GIANT of East Asia, South Korea's economy took off after the Korean War of the 1950s. South Koreans now enjoy a per capita income 20 times that of the North but desires for reunification remain strong. Relations began only in 2000, but South Koreans worry about the vast sums of capital that would be required to bring their northern cousins up to similar living standards.

Like its neighbor to the north, North KOREA, most of South Korea (Republic of Korea) is mountainous,

with higher peaks concentrated in the Taebaek Range, the “backbone,” running along the eastern coast of the peninsula. The western coast is far more level, with numerous inlets and thousands of islands—South Korea’s overall coastline is more than 1,488 mi (2,400 km), mostly because of these features. South Korea shares a border of 151 mi (248 km) with North Korea, and lies across the Korea Strait from Japan, and the Yellow Sea from CHINA. The climate is said to be one of the healthiest in the world, temperate most of the year, with the southernmost regions (notably the island of Cheju) lying within the subtropical zone, influenced by the warm Japan Current from the south.

The southeast also has resorts and hot springs near Pusan. While the south has more agricultural resources than the north, it lacks the north’s mineral resources and must import most of the raw materials needed in its factories. The central-west regions are the most fertile, growing rice, root crops, and fruit. Ginseng has been one of the country’s signature crops for centuries, centered on the town of Komsan, where richly mulched soil is carefully shaded by thatch or fiber mats, then left to fallow for 10 to 15 years before another planting. Most rivers are relatively short but navigable, like the Han (Han-gang), which flows through Seoul to its port city, Inchon, 24 mi (40 km) away. The many islands that lie off the west and southwest coast of Korea are mostly of volcanic origin and are noted for their beauty, coral beds, diverse marine life, sponges, and pearls. The largest, Cheju, 62 mi (100 km) south of the mainland, is mostly mountainous and famous for its mother-of-pearl. Its largest peak, Halla (6,435 ft or 1,950 m), looks white from a distance because of the large outcroppings of rock.

South Korea has six cities with populations over 1 million (and containing over half the total population): Pusan, Taegu, Taejon, Kwangju, and the conurbation of Seoul and Inchon, with a total of 13 million people. Seoul means “capital” and has been the center of various Korean kingdoms for centuries. The Koreans originally migrated from Manchuria and set up several small principalities, which were gradually united into one state by the end of the 7th century. These earlier tribal groupings were called the Han, from which the preferred modern name for the state is derived: Han’guk, or Tae-han.

The Kingdom of Koryo emerged in the 10th century, providing the country’s modern name, but it was transformed in the 14th century and renamed Joseon (or Choson, the name still preferred by North Korea). Influenced by Chinese politics and religion, Korea in

turn influenced Japanese society, notably through the introduction of Buddhism. A golden age of Korean history followed, during which the Koreans invented the world’s first movable metal type, developed a world-famous silk industry, and invented a new (non-Chinese) alphabet. Weakened by internal factions, Christian ideologies from Western missionaries, and government corruption, the kingdom closed its ports to all foreigners but the Chinese in 1864, until its ports were forced open by the Japanese, who gradually extended their influence over the peninsula from protectorate (1905) to outright annexation in 1910. Brutal imperialist rule by the Japanese over the succeeding decades remains a source of great resentment among Koreans. Liberated from Japanese rule by the UNITED STATES and the Soviet Union in 1945, the two powers’ rival occupation led to the Korean War of 1950–53, and the partition of the country into North and South.

The DMZ (demilitarized zone) dividing the two countries lies only 25 mi (40 km) north of Seoul, and the city grew significantly in the 1950s from the nearly 1 million refugees who fled the North. Land reform, education and economic expansion following the war has transformed the country from a poor agrarian society to one of the world’s most industrialized. Light industry changed over to heavy industry in the 1970s (steel, iron, chemicals), then to high-tech industries such as automobiles, ships, and electronics. Giant corporate conglomerates (known as *chaebols*, “fortune clusters”) are now known all over the world—Hyundai, Daewoo, and Samsung—and have become global in outlook (Daewoo Motors, for example, has factories in POLAND, UZBEKISTAN, and INDIA).

In 1996, the top four *chaebols* accounted for 80 percent of the GDP and 60 percent of the exports. Despite this prosperity, Koreans face increased population problems, especially with urban crowding and severe housing shortages. The government is encouraging the development of new centers of technological research and industry, notably in the cities of the south, especially Pusan, the country’s second largest city, and the country’s premier harbor.

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## Kosciusko, Mount

MOUNT KOSCIUSKO (also spelled “Kosciuszko”) is the highest point (7,310 ft or 2,228 m) in mainland AUSTRALIA. Named after the Polish military leader Thaddeus Kosciuszko (1746–1817), the mountain is a core component of the Kosciuszko National Park in the state of New South Wales. One of the Australian Alps national parks, the park is a UNESCO (United Nations) Biosphere Reserve. It contains six wilderness areas, and its alpine and subalpine areas contain herb fields, bogs, feldmarks and plant and animal species found nowhere else in the world. The park is also home to the headwaters of Australia’s biggest river system the Murray-Murrumbidgee, as well as several glacial lakes, including Blue Lake, which is also a wetland reserve.

Kiandra, in the north of the park, was the scene of one of the shortest gold rushes in Australia. The discovery of gold in 1859 led to a sudden influx of gold-seekers, so that by early 1860 there were about 4,000 people in the town, which had 25 stores, 14 hotels, and a jail. After 1861, once the rush was over, the population stabilized between 200 and 300. Kiandra is now a ghost town and a heritage attraction along with a number of other historic huts and homesteads that have become conserved as part of the cultural heritage of the region.

The first proposals to protect Mount Kosciusko and the surrounding regions were developed in the 1930s by the Sydney Bushwalking Club and the National Parks and Primitive Areas Council (NPPAC). In 1935 and 1936 the NPPAC exhibited a plan for the reservation of the region in Sydney. The proposed park was designed for the special purposes of water conservation, wildlife propagation, and public recreation of various kinds, including trail riding, recreational walking and motor camping. Despite the enthusiasm of the NPPAC for the conservation proposals, the main force for its eventual acceptance was more utilitarian conservation notions of the need for irrigation water, the production of hydro-electricity and soil protection.

On April 19, 1944, the Kosciusko State Park Act was assented to by the New South Wales Parliament. Besides the protection that the act gave to the Kosciusko region, it is significant for two reasons. First, it was the first national park in New South Wales that was provided with security of tenure through permanent reservation that could be revoked only by a special act of parliament. Second, it provided for the establishment of a primitive (wilderness) area. Despite

its conservation significance, the park served as the core of the Snowy Mountains Hydroelectric Scheme which was completed in 1972. The scheme left an extensive road network and lakes in the park that is now heavily used by tourists.

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## Kuroshio Current

THE KUROSHIO IS a warm northeasterly ocean current off the coast of JAPAN. This current is also called the gulf stream of the Pacific or Japan Current. Kuroshio means “the black stream” in Japanese, named after the deep ultramarine color of the high salinity water, which is found flowing north of the current’s axis. The system includes the following branches: Kuroshio, up to 35 degrees N; Kuroshio extension, extending eastward into two branches up to 160 degrees E longitude; North Pacific current, a further eastward continuation, which throws branches to the south as far as 150 degrees W; Tsushima current, branches of the main current that run into the Japan Sea, along the west coast of JAPAN; and Kuroshio counter-current, the large swirl or eddy on the east and south east of the Kuroshio.

The Kuroshio originates from the greater part of North Equatorial current, which divides east of the PHILIPPINES. The Kuroshio is the current running from Formosa to about 35 degrees N latitude. It continues directly as a warm current known as the Kuroshio Extension, from there it is continues as the North Pacific current. Water enters the Kuroshio over a broad front, 621 mi (1,000 km) in width, which then accelerates and narrows. A narrow band less than 62 mi (100 km) in width and about .6 mi (1 km) of maximum depth runs for 1,864 mi (3,000 km) along the western edge of the Pacific, between the Philippines and the east coast of Japan. A narrow, intense flow persists for 930 mi to 1,240 mi (1,500 to 2,000 km) after the current leaves Japan’s east coast, after which there is a marked drop



in velocity. Here, there is no land boundary on the left-hand side to generate a fractional boundary layer.

Kuroshio is a fast ocean current (2 to 4 knots). Every second, the current carries some 50 million tons of sea water past Japan's southeast coast, a flow equal in volume to about 6,000 rivers the size of the DANUBE or the VOLGA. On the whole, there are two distinct types of water in the current: warm, saline water on the right and cold, dilute water on the left. The current undergoes marked changes in speed in the location of its axis, which varies from place to place and with seasons. Apart from changes resulting from tides, short-term changes from a major shift in the axis of the Kuroshio can occur as it flows past southern Japan.

When meanders develop, cold water is brought up toward the surface between the Kuroshio and the coast, and the temperature drops to as much as 50 degrees F (10 degrees C) below normal. This change has a profound effect on coastal and offshore fisheries.

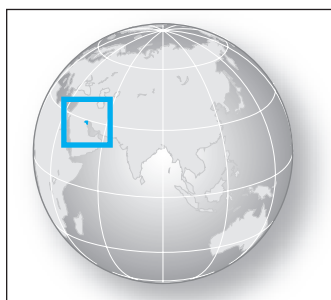
The Kuroshio Current plays a vital role in the circulation of the North PACIFIC OCEAN. The current involves great volumes of water capable of carrying large amounts of heat. The heat, which is carried north by this flow, has an effect on climate of the adjacent land areas. Water temperature offshore strongly influences cloud cover and rainfall. On the southern coast of ALASKA, the effect of the Kuroshio Extension creates a somewhat more temperate climate.

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## Kuwait

**Map Page** 1122 **Area** 6,880 square mi (17,280 square km) **Population** 2,183,161 **Capital** Kuwait City **Highest Point** 1,004 ft (306 m) **Lowest Point** 0 m **GDP per capita** \$17,500 **Primary Natural Resources** petroleum, fish, shrimp, natural gas.



KUWAIT IS A COUNTRY in the MIDDLE EAST, bordering the PERSIAN GULF, between IRAQ and SAUDI ARABIA. The establishment of Kuwait took place in the 18th century by an Arab tribal group that came north from QATAR. They selected a defensible position at a prominent point on the southern edge of a broad bay near the outflow of the Euphrates River, at the head of the PERSIAN GULF.

Kuwait, as its place name implies in Arabic, began as a fortification near the water. The location provided a suitable point for transfer of goods to and from ships and liaison with the camel caravans of Arabia and Mesopotamia. Kuwait lay just on the margins of the OTTOMAN EMPIRE and acted as a trading center for goods entering or leaving the established routes serving that vast domain. In 1751, the Al Sabah family became the principal leaders of the small coastal commercial state. This ruling dynasty continues in a hereditary emirate type of government. As other gulf emirates before him, the Kuwait emir formalized relations with the BRITISH EMPIRE and became a protectorate by treaty in 1899.

### UNIMAGINABLE WEALTH

Kuwaitis survived as traders and fishermen with meager wealth rising from the sea in the form of pearls. Oil was discovered in 1937 and once full exploitation began after World War II, unimaginable wealth began to rise from the desert. Kuwait quickly became a super-rich oil country and developed a robust welfare state. On June 19, 1961, Kuwait became fully independent from Britain. The next 30 years saw continued development of the petroleum industry and massive wealth accumulation by the Kuwaiti government. Virtually every aspect of a citizen's life, education, health care, and housing was subsidized or provided for by the state government.

In 1990, neighboring Iraq used alleged theft of oil from a shared oil field as a pretext for invasion and annexation. Several United Nations (UN) resolutions demanded Iraq restore the Kuwait government and withdraw its troops. A UN-sponsored, U.S.-led coalition of nations established a large military force in Saudi Arabia. Once the UN-declared deadline of January 15, 1991, passed, coalition forces conducted an air and ground campaign that resulted in the liberation of Kuwait. Kuwait rapidly rebuilt its ransacked nation and reestablished oil production. Kuwait then became the staging area for U.S. and coalition forces, which maintained UN-mandated economic and military sanctions against Iraq for over a decade. In 2003, a U.S.-led



U.S. Marines train in Kuwait in 1991 in preparation of driving Iraqi forces from the small, oil-rich nation.

coalition force launched a successful invasion of Iraq from Kuwait and other neighboring areas.

Kuwait's economy continues to be centered on the petroleum industry and the government sector. Its proven oil reserves account for about 10 percent of the world total. Kuwait's service and market sectors stand to benefit from the large-scale reconstruction and reorganization of the economy of Iraq. More than 90 percent of the population lives within the environs of Kuwait City and its harbor. An estimated 65 percent of the citizens of Kuwait, along with the royal family, belong to the Sunni branch of Islam.

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## Kyrghiz Steppes

THE KYRGHIZ STEPPES is a historic name for the region currently forming central and eastern KAZAKHSTAN. It is a broad plain with few to no trees and little moisture. It is a land of horses and cattle and wide-open plains. The name is confusing, and thus used less frequently today, since the actual Republic of KYRGYZSTAN contains no STEPPE at all, while the Republic of Kazakhstan is home to very few Kyrgyz people.

The confusion stems from the 18th- and 19th-century conquest of the region by imperial RUSSIA. Russian authorities were unclear about the differences between the Turkic peoples of the plains and those of the high mountain valleys to the south and east, and for a time, they were both known as Kyrghiz, or Kyrghiz-Kazakh and Kara- (or Black-) Kyrghiz, respectively. The languages of the two groups are nearly the same, and the Russians already used the term Kazakh, or Cossack, to refer to similar nomadic (though Slavic) people who lived in southern Russia. It was not until the 1920s, when the communists began to separate the peoples of Central Asia into ethnically defined autonomous republics, that the name Kazakh was used to distinguish the peoples of the steppes from those of the mountains.

Like the rest of the steppes that cross most of southern Russia, the steppes of northern Kazakhstan are broad flat plains that contain enough moisture to support grasses, but not enough to allow for denser vegetation and forests.

The Kyrghiz Steppes in particular forms the northern third of Kazakhstan and can be divided into two zones. The western zone is in the center of the country, known as the Turgai plateau, starting north and northeast of the ARAL SEA. This plateau is marked by a central depression, with a chain of lakes stretching up to the Russian border. This was once a strait connecting two inland seas, millions of years ago. The Turgai and Irgiz rivers flow into semisalty lakes, which sometimes disappear altogether in especially dry periods. The eastern region is known as the Kazakh folded steppe

and is generally hillier, with scattered higher massifs, including the Ulu-Tau, Karkaral, and Chingiz-Tau mountains. Geologically, these folds are related to the folds in the Altai and TIAN SHAN ranges. Some of these areas are rich in mineral resources, and cities were developed during the Soviet era, such as Karaganda, the fourth-largest coal-producing city in the former Soviet Union. These cities always struggled to provide themselves with enough water, however, both for their growing populations and for industrial needs. Water resources from the Irtysh Valley in the northern edge of this steppe were used for these purposes, as were waters from the Ili River, which flows into Lake BALKHASH, and waters that were diverted from the Syr Darya far to the south, resulting in the serious shrinkage of the Aral Sea.

Other projects initiated during the Soviet era converted large percentages of the formerly open steppes into cultivated agricultural land, again with serious drain on local water resources and a change in the traditional nomadic lifestyle of the local population.

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## Kyrgyzstan

**Map Page** 1119 **Area** 76,641 square mi (198,500 square km) **Population** 4,892,808 **Capital** Bishkek **Highest Point** 24,407 ft (7,439 m) **Lowest Point** 433 ft (132 m) **GDP per capita** \$1,600 **Primary Natural Resources** hydropower, gold, coal, oil.



**LANDLOCKED AND MOUNTAINOUS**, the Kyrgyz Republic achieved its independence in 1991 following the collapse of the Soviet Union. Kyrgyzstan features spectacular mountain vistas and incredible natural beauty reminiscent of SWITZERLAND. Despite its natural beauty and recent attempts to develop a thriving tourist industry, Kyrgyzstan remains mired in poverty.

Additional challenges include implementing democracy, combating ethnic tensions, and thwarting terrorism. Central Asia's second-smallest country in terms of area, Kyrgyzstan borders KAZAKHSTAN to the north, CHINA to the east, TAJIKISTAN to the south, and UZBEKISTAN to the west.

Kyrgyzstan is dominated by the TIAN SHAN (primarily) and Pamir (in the south) mountain ranges. The vast majority of the country (roughly 75 percent) is continuously covered by snow and glaciers. Traversing the Tian Shan remains relatively difficult, as a summer trip from the northern capital of Bishkek to the southern second-largest city of Osh (a distance of 186 mi or 300 km) takes more than 10 hours by automobile. Kyrgyzstan is also home to numerous alpine lakes, the largest and deepest of which is Lake Issyk-Kul, located near the Kazakh border in the north. The lake reaches a depth of 2,300 ft (700 m); its clear, sky-blue water and health resorts make the lake a popular tourist destination. For a country its size, Kyrgyzstan has surprising climatic variability, ranging from polar to dry continental through the mountains, to temperate northern foothills, to subtropical in the southwest. Kyrgyzstan's most valuable natural resource may be its gold deposits. The Kyrgyz republic was home to the Soviet Union's largest gold mine (Makmal), which continues to be one of the largest proven gold reserves in the world.

Kyrgyzstan's population is ethnically diverse, including Kyrgyz (64.9 percent), Uzbek (13.8 percent), Russian (12.5 percent), Dungan (1.1 percent), Ukrainian (1 percent), and Uygur (1 percent) peoples. Population distribution is concentrated in the Fergana, Talas, and Chu valleys and is centered in the cities of Bishkek (the capital, 2004 population 866,300) and Osh (2004 population 229,700). Most citizens are adherents to the religion of Islam (75 percent), although a sizable minority of Russian Orthodox (20 percent) exists. A secular state, Kyrgyzstan has two official languages, Kyrgyz and Russian.

Kyrgyzstan's economy, like that of other poor countries, is dominated by the agricultural sector. A full 55 percent of the labor force is engaged in farming. Nomadic herders raise sheep (for both meat and wool), cattle, and yaks. Other agricultural products include cotton, tobacco, and a variety of vegetables. Industry, which accounts for just 15 percent of the labor force, is limited to gold, small machinery, textiles, and food processing. During its first decade of independence, Kyrgyzstan implemented more market-oriented economic reform but experienced slower economic



growth than the other former Soviet republics of Central Asia.

Perhaps the most pressing geographical/political issue facing Kyrgyzstan is its complex western boundary with Uzbekistan and Tajikistan. Three large Tajik exclaves exist entirely within Kyrgyzstan's borders, and a serious boundary dispute continues with Uzbekistan. Here, seemingly arbitrary boundaries fragment ethnic groups and unite dissimilar peoples. Kyrgyzstan's relative location has also fostered a growing problem of illegal narcotics traffic. The country has become a corridor for the movement of opium and heroin produced in AFGHANISTAN and Tajikistan, bound for the European market. Combating terrorism represents an additional problem confronting Kyrgyzstan. Radical Islam has penetrated the country, and Osh is considered by many to be the Soviet Central Asian headquarters of Wahhabism.

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## Kyushu Mountains

THE KYUSHU MOUNTAINS form the high, elevated central portion of the Japanese island of Kyushu, the southernmost of JAPAN's four main islands. Running roughly diagonally across the island, northeast to southwest, they cut Kyushu into a northern and southern sector. These sectors differ markedly from each other in many ways, from geology to economics: the north is urban and industrial, while the south is agri-

cultural and poorer. The central part of the range has peaks over 3,300 ft (1,000 m), with the highest elevations at the northern end, overlooking the Aso ash and lava plateau. Mount Aso is the world's largest volcano and last erupted in January 2004, highlighting the range's status as one of the most geologically active places on the planet, with numerous volcanoes and hot springs, such as the famous resort at Beppu.

The island of Kyushu lies at the intersection of three tectonic plates. The core of the island was formed where the Seinan mountain arc (coming south from the island of Honshu) intersects with the mostly submerged arc of the Ryukyu Islands, which penetrates Kyushu from the south. The topography is broken up into narrow valleys cutting through steep slopes. The Kuma River is the chief waterway and flows northward into a gorge famous among trekkers. Restricted lowland area means that there has been a high degree of terracing for rice cultivation, though the population in general is rather sparse compared to the rest of Japan.

Orange groves and forestry dominate the local economy, though there has been recent growth in mineral processing industries (gold, copper, petroleum) on the eastern coast, where the ruggedness of the coast—with mountains descending directly into the sea in places—has created small protected natural harbors with relatively deep waters. The Ono River provides the needed water for these factories, as well as hydroelectric power.

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## lacustrine plain

**ALSO CALLED** A lake plain, a lacustrine plain is an area created out of deposition largely related to the past existence of lakes in the area, although in some cases, the original lakes still exist, having shrunk in size over time. Lacustrine refers to the condition of being affected by a lake or several lakes. Lacustrine plains are some of the flattest of all landform features and have few surface interruptions, although they may contain freshwater marshes, aquatic beds and lakeshore environments. Lacustrine plains are of varying origin, but most are underlain by fine, flat-bedded silt and clay deposited in lakes. The plains are typically related to the impoundment of water by one of the following processes: GLACIATION, differential uplift, and lake creation in now-arid inland basins.

Lacustrine plains that are glacial in origin are known as glaciolacustrine plains, and these are largely created from the trapping and ponding of water on the irregular land surface left by the former continental glaciers. In regions where there were thick masses of stagnating continental ice, steep-sided holes through the dead ice occasionally held lakes. Water was retained in these lakes by the ice walls. Fine-grained sediments (muds) accumulated on the lake bottoms. Once the ice walls melted away, however, the lakes drained, leaving the lake bottoms as plateau-like features under-

lain by fine-grained sediments. These lakes are largely ephemeral or temporal, eventually draining after the ice is gone. The present Great Lakes region in North America is bordered in many places by extensive lacustrine plains showing the former extent of the lakes. The Lake Agassiz plain is the biggest of these, reflecting the size of the former lake which was bigger than all the present Great Lakes put together.

The lack of topography of glaciolacustrine plains is due to the infilling of deep parts of the lake with clays and silt and wave erosion on the shallower parts of the lake. In North America and some other parts of the world, glaciolacustrine plains are of greatest interest because they often provide suitable land for intensive agriculture, and their flat topography permits mechanized farming. Lake ERIE and Saginaw Bay on Lake HURON were once much higher and extended inland, and the bottom of those bodies of water now makes up the lacustrine plains near Saginaw and Monroe. Large cities such as Chicago, Cleveland, Detroit, and Toledo also originated on the flat plains, where the dry beach ridges of the former lake edges served as roads. The flat lacustrine plains continue to absorb the urban expansion of these cities today. One handicap is that such areas are also poorly drained. Chicago lies on a plain formed when Lake MICHIGAN stood higher, and the city is often beset by the flooding of sewers, basements, and underpasses.

Other lake plains not associated with glaciers include the Congo Lake Plain and the lake plain of south SUDAN in Africa. These broad, flat plains of fine sediment were formed originally as enormous, in-filled basins created through differential uplift during the middle and late Pleistocene. The lakes were drained when the NILE and CONGO rivers eventually eroded their valleys, exposing large expanses of the former lake floors.

Lacustrine plains are also found in inland sites of present arid areas. The lakes associated with these plains were formed in a time of increased rainfall and reduced evaporation. The Chad Basin Plain in Africa, the Lake Eyre Plain in central AUSTRALIA, the plains around the CASPIAN SEA and the plains formed by Lake Bonneville in western UTAH are notable examples.

The size of lacustrine plains varies according to the size of the original lake. The Superior Lake Plain, covering parts of the U.S. states of MICHIGAN, MINNESOTA, and WISCONSIN, is roughly 1,910 square mi (4,950 square km) in size. The Chad Basin Plain extends to about 919,554 square mi (2,381,635 square km) in size and is shared by seven countries: NIGERIA, NIGER, ALGERIA, Sudan, CENTRAL AFRICA REPUBLIC, CHAD, and CAMEROON.

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## land bridge

IN GEOMETRICAL TERMS, a square also qualifies as a rectangle—a four-sided plane figure with four right angles—but a rectangle does not always meet the criteria to be a square—a figure having four equal sides. Such is the case with land bridges and isthmuses. An isthmus qualifies as a land bridge—a strip of land linking two landmasses, allowing free migration in both directions—but a land bridge is not always an isthmus, which is a narrow land bridge; the Isthmus of Panama, measuring 30 mi (48 km) at its narrowest

point, for example, is an isthmian land bridge, whereas the Bering land bridge is believed to have been approximately 1,000 mi (1,609 km) wide during the Pleistocene Ice Age and would not have been considered an isthmus.

Land bridges are temporary in nature, and can disappear and reappear when geologic changes occur to the land or when the sea levels rise and submerge them or lower to expose these bridges of land. In addition to the above-mentioned Bering land bridge between Siberian Asia and ALASKA, the SINAI PENINSULA (23,500 square mi or 61,000 square km) is a triangular land bridge, linking northeast Africa with southwest Asia, and is home to over 200,000 people (1986). The Torres Strait waters (90 mi or 145 km wide) between PAPUA NEW GUINEA and AUSTRALIA have contained various land bridges when the sea levels were lower, exposing the continental shelf.

The migration of people and species across land bridges during glacial periods is what interests many scientists. Numerous species of flora, fauna, and animals have extended their ranges to new lands because of the isthmuses and land bridges that have intermittently connected different lands. Today, it is believed that the first humans in North America entered by way of the Bering land bridge, also referred to as Beringia, and although many Native Americans dispute these claims based on spiritual beliefs, archaeologist finds in both SIBERIA and the Bering land bridge region indicate similar tools, dwellings, and practices distinct to the Siberian region, suggesting there was a human migration between the two regions. Beringia was wide grassland and it is highly likely that people made it a home—however brief because of the cold climate.

The population of the Sinai Peninsula is primarily along the coast, and the main industries include fishing, mining, and tourism. Harsh weather makes this land bridge a natural barrier between the competing interests in the surrounding countries. The ongoing disagreements have led to several conflicts, primarily over the Suez Canal along the western perimeter of the peninsula. Active land bridges serve as important trade routes, and the Sinai Peninsula controls much of the trade between Asia and Africa, illustrating the role past land bridges have played.

In the Torres Strait, several islands composed primarily of granite in the western waters are all that remains of the land bridge. These islands include Waiben, Badu, Kiriri, and Gebar, among others. It is possible to see Pleistocene volcanoes in the area, and approximately 17 islands in the Torres Strait are cur-

rently inhabited. The islands act almost like stepping-stones between Australia and Papua New Guinea, with a “trail” of flora, fauna, people, and customs traceable from landmass to landmass.

Geological similarities between Africa, South America, Australia, INDIA, and ANTARCTICA indicate that 150 to 300 million years ago, a supercontinent, referred to as Gondwana or Gondwanaland, made up of these countries could have existed. Recent studies suggest that land bridges might have connected the regions, rather than one large land mass, and new developments in the fields of geology and geography will likely help to answer these questions in the future.

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## landlocked

APPROXIMATELY ONE-FIFTH of the world’s countries have no access to the oceans or ocean-connected seas, classifying them as landlocked. Today, there are 42 landlocked countries, including LIECHTENSTEIN and UZBEKISTAN, considered doubly landlocked because they have no access to the oceans and neither does any country that surrounds them. The main issues to consider with a landlocked country include the high transportation costs of trade, coordinating logistics and working trade relationships with neighboring countries, and in some cases, volatile climates.

Fifteen of Africa’s 47 continental countries, including BOTSWANA, BURKINA FASO, BURUNDI, CENTRAL AFRICAN REPUBLIC, CHAD, ETHIOPIA, LESOTHO, MALAWI, MALI, NIGER, RWANDA, SWAZILAND, UGANDA, ZAMBIA, and ZIMBABWE, have no access to the ocean.

Most of these countries are among the poorest in the world, and only those rich in gem and mineral resources have escaped extreme poverty. Poor transportation routes have impeded trade and prevented advances in technology from being readily available to many of these countries, facilitating the spread of dis-

ease, including HIV/AIDS, in naturally isolated areas. Improved education within the countries only empowers highly trained students to emigrate, and politically, domestic policies do little to combat the geographical barriers between landlocked and neighboring nations.

When the Democratic Republic of the CONGO was created, the country negotiated for a thin strip of land on the north end of ANGOLA, providing the country with just 23 mi (37 km) of access to the ATLANTIC OCEAN—enough to cut transportation costs by half of what they would have been without the ocean access. Botswana, Lesotho, NAMIBIA, and Swaziland have formed a customs union, allowing them greater economic control with South Africa, their main trading partner.

KAZAKHSTAN is the largest landlocked country (1.03 million square mi or 2.67 million square km) and is bordered by CHINA, KYRGYZSTAN, RUSSIA, TURKMENISTAN, Uzbekistan, and the CASPIAN SEA, a landlocked body of water. Kazakhstan is rich in oil and natural gas resources and has become more integrated in the world economy and the development of trade resources among other landlocked countries. In 1994, Kazakhstan joined with the two adjoining landlocked countries—Uzbekistan, doubly landlocked, and the Kyrgyz Republic—to establish a “free-trade zone” among the countries, strengthening their economic standing in Asia. The borders between Kazakhstan and Russia, AZERBAIJAN (across from Kazakhstan on the Caspian Sea), turkmenistan, and the Caspian Sea are currently under negotiation.

Other landlocked countries include the Asian nations of AFGHANISTAN, BHUTAN, LAOS, MONGOLIA, NEPAL, and TAJIKISTAN. The European landlocked nations include ANDORRA, ARMENIA, AUSTRIA, BELARUS, CZECH REPUBLIC, HUNGARY, Liechtenstein, LUXEMBOURG, former Yugoslav republic of MACEDONIA, MOLDOVA, SAN MARINO, SLOVAKIA, SWITZERLAND, and VATICAN CITY, the world’s smallest country. BOLIVIA and PARAGUAY are the only landlocked countries on the American continents and are both located in South America, though Paraguay is able to access the ocean via a long series of river connections over 1,000 mi (1,600 km) long.

Historically, countries have made extreme efforts to avoid being landlocked. In the 16th century, RUSSIA was considered landlocked part of the year when the ARCTIC OCEAN froze the country’s only ports. A prime motivating factor in the country’s expansion was the economic necessity of warmer ports. Ocean access can be an important part of political negotiations because of the economic resources a country can access. Once a

part of the Third Reich during World War II, Gdansk (Danzig) was decreed to POLAND in 1945 as part of the Potsdam Conference, providing the country with its only ocean access.

Several countries, including ERITREA, MONTENEGRO, and the Republic of BOSNIA AND HERZEGOVINA have negotiated independence with access to the ocean as a key element in defining borders. The 12 mi (20 km) of coastline along the ADRIATIC SEA that is part of Bosnia and Herzegovina actually splits the Croatian territories into two segments. But knowing the important economic impact a country's ocean access plays, compromises to get even a small amount of ocean access was crucial to a successful bid for Croatia's national independence.

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## Laos

**Map Page** 1124 **Area** 91,429 square mi (236,800 square km) **Population** 5,921,545 **Capital** Vientiane **Highest Point** 9,240 ft (2,817 m) **Lowest Point** 230 ft (70 m) **GDP per capita** \$326 **Primary Natural Resources** timber, hydropower, gypsum.



LAOS, THE ONLY landlocked (without any ocean coastline) Southeast Asian country, is one of the poorest of the world, with 40 percent of its population living below the poverty line. Its six-century-old monarchy, which also included French occupation (1893–1953), had dual capitals in Vientiane and Luang Prabang. The monarchy ended in 1975, when the communist Pathet Lao rebel forces, backed by North Viet-

nam, took control of the government. Laos turned into a communist satellite of the Soviet Union and VIETNAM but maintained a more neutral position than Vietnam and CAMBODIA. After aid from the Soviet Union ceased in 1991, the UNITED STATES, JAPAN, and international agencies provided the aid, without which the country would have been in great difficulty. The post-1975 collectivization of farms and nationalization of a few industries were replaced by a return to market economy and liberal foreign investment laws. Laos remains a communist country.

Western and northern parts of Laos are mountainous; the former includes a part of the Annamite Cordillera, where there are areas that receive 80 to 120 in (203 to 305 cm) of rainfall. Vientiane, the capital receives 68 in (173 cm) annually. Being in a monsoon climatic regime, there is a great deal of uncertainty about rainfall. Only 3.47 percent of the land is arable though 80 percent of the labor force is engaged in agriculture. Rice dominates the food crops and accounts for about three-fourths of the total crops produced.

Laos is self-sufficient in rice, but it needs money to run the government and other activities. Its primary production-related industries (tin, beef, pork, cigarettes, and wood) are in their primitive stages. Upper reaches of the MEKONG RIVER on the western part of the country collect most of the drainage from the rest of the country. The Mekong is suitable for navigation only in sections because of several rapids.

## POPULATION GEOGRAPHY

The population of Laos shows characteristics of a less-developed country: more people in the lower age groups (42 percent are in the age group 1 to 14 years); high birth rates (37 births per 100 people); low life expectancy (54 years); high infant mortality rate (89 per 1,000 births); and a high fertility rate (4.94 children born per woman in reproductive age). Sixty percent of Laotians are Buddhist and the remaining 40 percent are animists and others.

There are three strata of people in Laos: 1) Austro-Asiatic group, consisting of 25 percent of the country's population. They were the earliest settlers but were driven into the mountains above 3000 ft (914m) by the Tai and Lao; 2) Lao Loum, who originated from South China and live in the most productive lowland river valleys, growing glutinous rice, accounting for 68 percent of the country's population. They are the most educated and are the major decision makers; 3) Lao Sung, consisting of 9 percent of the population, are the 19th-century migrants from South China, living in the



northern highlands. There is an ongoing government policy of “Laoization,” in which efforts are made to acculturate the Lao Theung and Lao Sung minorities in Lao Loum cultural traits. The government encourages ethnic harmony.

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## latitude and longitude

LATITUDE AND LONGITUDE are points on lines that graph the Earth and allow cartographers and others, by assigning measurements to the lines, to fix the location of any place. Latitude lines run east and west and are also called parallels; longitude lines run north and south and are known as meridians. The measurements for both are given in degrees; more exact locations are expressed by increments of minutes and seconds.

Lines indicating latitude circle the globe in an east-west direction, between the North and South Poles. Latitude lines parallel the equator, itself an imaginary line but one that can be determined with exactness. The equator lies midway between the North and South Poles and is assigned a latitude of 0 degrees. All other points are given in relation to their distance north or south of the equator. The highest latitude possible is 90 degrees, which is the latitude of the North and South Poles: 90 degrees N and 90 degrees S. Each degree of latitude extends 69 mi (111 km).

Ptolemy was the first to use latitude and longitude lines and measure them in degrees in his book, *Geography*, written around 150 B.C.E. Today, well-known lines of latitude enclose the ANTARCTIC and ARCTIC CIRCLES at 66 degrees 33 minutes south or north, which defines the area that experiences at least one full day of

darkness in winter. Other named latitude lines are the Tropics of Capricorn and Cancer, which are at 23 degrees 27 minutes south or north. The TROPIC OF CAPRICORN and the TROPIC OF CANCER mark the points furthest south and north, where the sun can be seen directly overhead at least one day during the year.

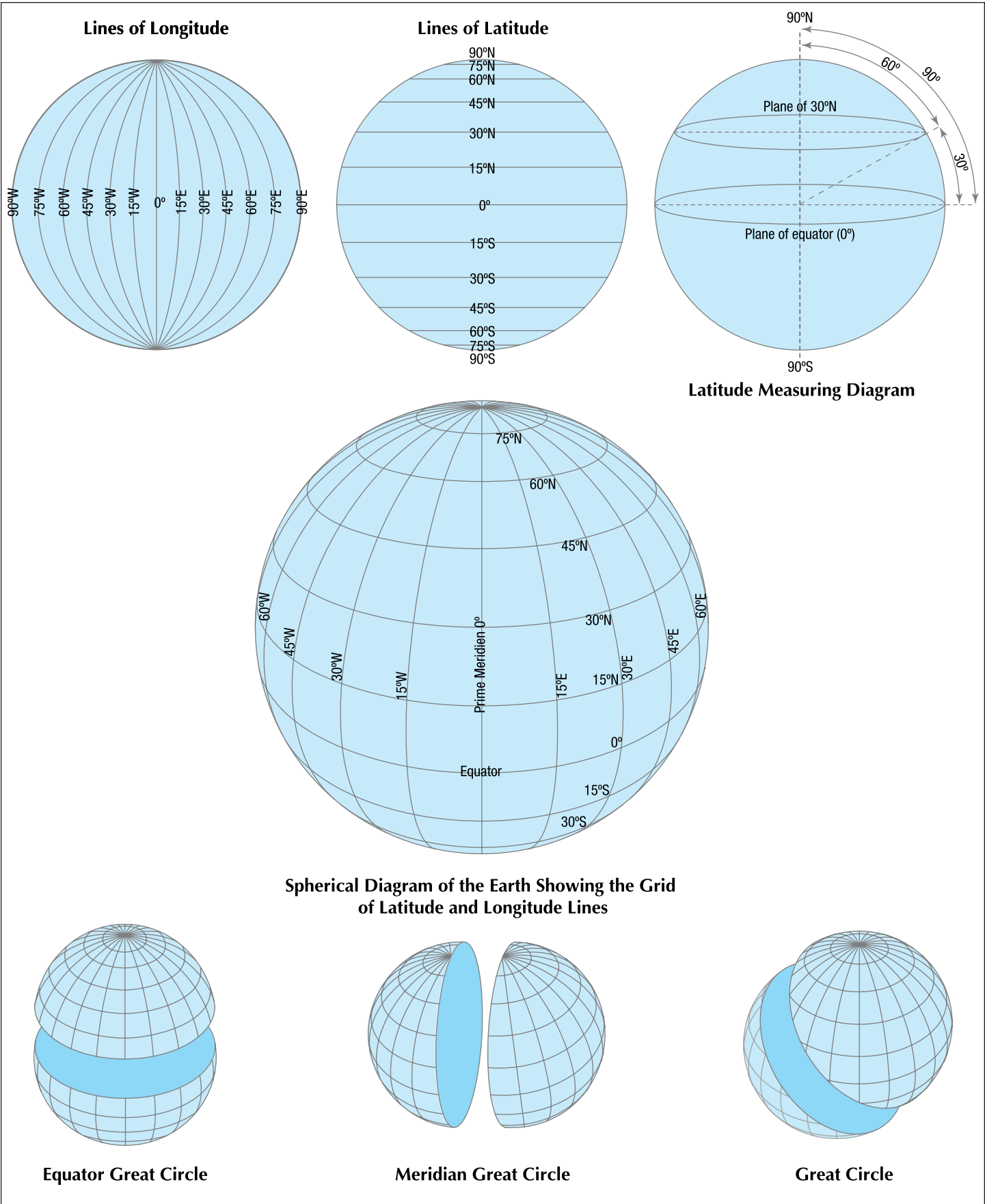
Longitude lines, which had been envisioned on maps from Ptolemy’s time, were far more difficult to fix with accuracy. While the north-south lines can be drawn anywhere on a globe, the questions of where to place 0 degrees and how to measure from it were not resolved until recently. Unlike latitudes, which parallel each other, longitudinal lines are further apart from each other at the equator, and converge at the poles.

Since the measurement of any such line could follow the sun, going from east to west, it can be a measurement of time as well as distance. The Earth is 360 degrees, divisible by 24-hour periods; the Earth rotates 15 degrees each hour. For ships at sea, figuring longitude—and thus, their own location—meant knowing the exact time in their home port, as well as the exact time at sea, and measuring the difference. In 1714, the British Longitude Act offered a prize of 20,000 pounds to anyone who could track longitude with an accuracy of .5 degrees.

In the 1770s, the prize was won by a clockmaker named John Harrison, whose chronometers were proved accurate on voyages with Captain James Cook. In 1884, the British government declared that the meridian running through the Greenwich Observatory near LONDON, England, would be the prime meridian, with a measurement of 0 degrees. Previous to that, and previous to acceptance of that decree by other countries, other meridians had served as 0 degrees. Washington D.C. and PARIS, FRANCE, for example, measured longitude from their own Prime Meridians.

Traveling west from the Greenwich Observatory, any spot between 0 degrees and 180 degrees, is considered west longitude. The line at 180 degrees is exactly opposite the Prime Meridian on the other side of the Earth, and serves as the INTERNATIONAL DATE LINE. Going east, any location between 0 degrees and 180 degrees is designated east longitude.

Fixing latitude and longitude in the 21st century relies more on satellite technology than chronometers. The Global Positioning System (GPS) was developed and deployed by the U.S. Department of Defense to find coordinates on or above the Earth. Electronic receivers decode and triangulate the information from this system to give latitude, longitude, and elevation. GPS receivers have varied uses: scientists and engineers



measure tectonic movement, industries track their vehicles, and ordinary consumers navigate while sailing or hiking. Civilian use is deliberately degraded and limited to 100 meters, while military use of Precision (P) code is accurate to 20 meters.

GPS is called NAVSTAR (an acronym for Navigation System with Timing and Ranging) by the U.S. military, and became fully operational in 1994. Between 1989 and 2004, 50 GPS satellites had been deployed. A minimum of 24 circle the globe on six orbital planes.

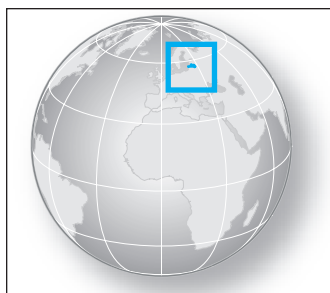
Longitude and latitude coordinates may be collected by a GPS receiver and uploaded into a geographic information system (GIS). Data capture (the insertion of information into the system) requires identifying the objects on a map and noting their precise global positions and their spatial relationships. Information from satellite images or aerial photographs may also be extracted with computer software and placed into the database. Existing digital information that is not in map form can be converted by GIS into usable form.

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## Latvia

**Map Page** 1130 **Area** 24,937 square mi (64,589 square km) **Population** 2,348,784 **Capital** Riga **Highest Point** Gaizinkalns 1,017 ft (311 m) **Lowest Point** 0 m **GDP per capita** \$8,300 **Primary Natural Resources** peat, limestone, dolomite, amber.



ON THE EASTERN shore of the Baltic Sea in northern Europe, the Republic of Latvia is a flat country that borders ESTONIA to the north, LITHUANIA to the south,

BELARUS to the southeast, and RUSSIA to the east. Latvia is a parliamentary democracy with the supreme council, or Saeima, serving as the legislature and a president as head of state.

Most of Latvian topography is a flatland consisting fields, forest, lakes, marshes, and navigable rivers, with the exception of small hills east of Riga and to the southeast. Its chief rivers are the Daugava, Guja, Venta, and Lielupe. The major cities in Latvia are Riga, Daugavpils, Liepaja, and Jurmala. The country is marked by a long coastline indented by the Gulf of Riga to the northwest and some natural harbors. The climate is humid with only 30 to 40 days of sunshine per year. Temperatures range from 28 degrees F (-2 degrees C) in January to 63 degrees F (17 degrees C) in June.

The first permanent human settlements in what is now Latvia date at least to 9000 B.C.E. by migrations from the south and the southwest. From the 12th century onward, Latvia transferred from the rule of the Teutonic Knights, to the Poles, to the Swedes, and to the Russians. A Latvian national consciousness was formed by the early 19th century by its intellectuals, later to be transformed into an independence movement. Russian military weakness in World War I provided the opportunity for Latvia to gain independence in 1920.

The fledgling republic was beset by conflicts between fascists on the right and communists to the left. In June 1940, Latvia was occupied by the Soviet Union and later invaded by Nazi Germany. In 1944, Latvia was reoccupied by the Soviet Union and incorporated as a Soviet republic after World War II. In 1991, Latvia gained its independence from the Soviet Union and, with its neighbors Lithuania and Estonia, did not join the Commonwealth of Independent States, which arose from the demise of the Soviet Union. The last Soviet troops withdrew from Latvian soil in August 1994. Latvia became a member of the EUROPEAN UNION in May 2004.

Latvians or Letts make up 54 percent of the population. The next largest groups include Russians, Belarussians, Ukrainians, and Poles. Incorporating its Russian minority poses a challenge for the new Latvian society, still bitter over Soviet and earlier occupations.

Latvia's fastest-growing exports are in the fields of biotechnology, pharmaceuticals, and timber, the country remains heavily dependent on energy, particularly from Russia. Independence from the Soviet Union also meant the start of a free-market economy. Despite hardships caused by economic reform, Latvia has been

generally successful in emerging as an independent state.

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## Law of the Sea

THE LAW OF THE SEA is a compilation of international and national laws regulating the demarcation of areas of maritime jurisdiction appertaining to maritime states. While its origins were military and defensive today it focuses on respective rights of resource exploitation—oil and minerals as well as fisheries. The importance of international innocent passage via geopolitical choke points and along multinational rivers also is relevant.

The oceans had long been subject to the freedom of the seas and innocent passage doctrine, a principle put forth in the 17th century designed essentially to limit national rights and jurisdiction over the oceans to a narrow belt of sea surrounding a nation's coastline. The remainder of the seas was proclaimed to be free to all and belonging to none. While this situation prevailed into the 20th century, by mid-century there was an impetus to extend national claims over offshore resources.

There was growing concern over the toll taken on coastal fish stocks by long-distance fishing fleets and over the threat of pollution and wastes from transport ships and oil tankers carrying noxious cargoes that plied sea routes across the globe. The hazard of pollution was ever present, threatening coastal resorts and all forms of ocean life. The navies of the maritime powers were competing to maintain a presence across the globe on the surface waters and even under the sea.

All maritime countries have claimed some part of the seas beyond their shores as part of their sovereign territory, a zone of protection to be patrolled against smugglers, warships, and other intruders. At its origin, the basis of the claim of coastal states to a belt of the sea was the principle of protection; during the 17th and 18th centuries, another principle gradually

evolved: that the extent of this belt should be measured by the power of the littoral sovereign to control the area.

In the 18th century, the so-called cannon-shot rule gained wide acceptance in Europe. Coastal states were to exercise dominion over their territorial seas as far as projectiles could be fired from cannon based on the shore. According to some scholars, in the 18th century the range of land-based cannons was approximately one marine league, or three nautical miles. It is believed that on the basis of this formula developed the traditional 3-mi (4.8-km) territorial sea limit.

By the late 1960s, a trend to a 12-mi (19.3-km) territorial sea had gradually emerged throughout the world, with a great majority of nations claiming sovereignty out to that seaward limit. However, the major maritime and naval powers clung to a 3-mi limit on territorial seas, primarily because a 12-mi limit would effectively close off and place under national sovereignty more than 100 straits used for international navigation.

In 1973, an international conference aimed at reaching an agreement was convened in New York. Nine years later in 1982, it adopted a constitution for the seas: the United Nations Convention on the Law of the Sea. During those nine years, representatives of more than 160 states sat down and discussed the issues and bargained and traded national rights and obligations in the course of the marathon negotiations that produced the convention.

Among the more important aspects of the convention are navigational rights, territorial sea limits, economic jurisdiction, legal status of resources on the seabed beyond the limits of national jurisdiction, passage of ships through narrow straits, conservation and management of living marine resources, protection of the marine environment, a marine research regime, and, a more unique feature, a binding procedure for settlement of disputes between states. In short, the convention is an unprecedented attempt by the international community to regulate all aspects of the resources of the sea and uses of the ocean and thus bring order to one of mankind's very source of life.

### TERRITORIAL WATERS

Territorial waters are the belt of sea adjacent to shores that states claim as being under their immediate territorial jurisdiction, subject only to a right of innocent passage by vessels of all nations. As to the breadth of the belt and the exact nature of this right of innocent passage, however, there is still much controversy. The



3-mi limit recognized and practiced by Great Britain, FRANCE, and the UNITED STATES seems to have been derived from the cannon range of the period, when it was adopted between Great Britain and the United States, toward the close of the 18th century.

The doctrine satisfied a requirement of the time and became a maxim of international law throughout northern Europe, both for the protection of shore fisheries and for the assertion of the immunity of adjacent waters of neutral states from acts of war between belligerent states. GERMANY still holds, in principle, to this varying limit of cannon range. NORWAY has never agreed to the 3-mi limit, maintaining that the special configuration of its coastline necessitates the exercise of jurisdiction over a belt of 4 mi (6.4 km). SPAIN lays claim to jurisdiction over 6 mi (9.6 km) from its shores.

Traditionally, smaller states and those not possessing large, ocean-going navies or merchant fleets favored a wide territorial sea in order to protect their coastal waters from infringements by those states that did. Naval and maritime powers, on the other hand, sought to limit the territorial sea as much as possible, in order to protect their fleets' freedom of movement.

As the work of the conference progressed, the move toward a 12-mi territorial sea eventually gained universal acceptance. Within this limit, states are in principle free to enforce any law, regulate any use, and exploit any resource. The convention retains for naval and merchant ships the right of innocent passage through the territorial seas of a coastal state. This means, for example, that a Japanese ship, picking up oil from a gulf state, would not have to make a 3,000-mi (5,000-km) detour in order to avoid the territorial sea of INDONESIA, provided passage is not detrimental to Indonesia and does not threaten its security or violate its laws.

In addition to their right to enforce any law within their territorial seas, coastal states are empowered to implement certain rights in an area beyond the territorial sea, extending for 24 nautical miles from their shores, for the purpose of preventing certain violations and enforcing police powers. This area, known as the contiguous zone, may be used by a coast guard or its naval equivalent to pursue and, if necessary, arrest and detain suspected drug smugglers, illegal immigrants, and customs or tax evaders violating the laws of the coastal state within its territory or the territorial sea.

Largely ignored were the problems such as multiple states claiming the same maritime zones, as in the South China and East China seas, and disputes over control of the sea when two nations, such as CHINA and

TAIWAN, claim different governments. In short, the devil is in the geographic and geopolitical details.

### EXCLUSIVE ECONOMIC ZONE

The exclusive economic zone (EEZ) is one of the most revolutionary features of the convention, and one that already has had a profound impact on the management and conservation of the resources of the oceans. Simply put, it recognizes the right of coastal states to jurisdiction over the resources of some 38 million square nautical miles of ocean space. To the coastal state falls the right to exploit, develop, manage, and conserve all resources—fish or oil, gas or gravel, nodules or sulphur—to be found in the waters, on the ocean floor, and in the subsoil of an area extending 200 mi (321.8 km) from its shore.

The EEZs are a generous endowment indeed. About 87 percent of all known and estimated hydrocarbon reserves under the sea fall under some national jurisdiction as a result. So too will almost all known and potential offshore mineral resources, excluding the mineral resources (mainly manganese nodules and metallic crusts) of the deep ocean floor beyond national limits. And whatever the value of the nodules, it is the other nonliving resources, such as hydrocarbons, that represent the presently attainable and readily exploitable wealth.

The most lucrative fishing grounds, too, are predominantly the coastal waters. This is because the richest phytoplankton pastures lie within 200 miles of the continental masses. Phytoplankton, the basic food of fish, is brought up from the deep by currents and ocean streams at their strongest near land and by the upwelling of cold waters where there are strong offshore winds. The desire of coastal states to control the fish harvest in adjacent waters was a major driving force behind the creation of the EEZs.

Today, the benefits brought by the EEZs are more clearly evident. Already 86 coastal states have economic jurisdiction up to the 200-mi limit. As a result, almost 99 percent of the world's fisheries now fall under some nation's jurisdiction. Also, a large percentage of world oil and gas production is offshore. Many other marine resources also fall within coastal-state control. This provides a long-needed opportunity for rational, well-managed exploitation under an assured authority.

Coastal states also have certain rights in the CONTINENTAL SHELF, comprising the seabed and its subsoil that extend beyond the limits of its territorial sea throughout the natural prolongation of its land terri-

tory to the outer edge of the continental margin, or to a distance of 200 mi from the baselines from which the territorial sea is measured, where the outer edge of the continental margin does not extend up to that distance.

In cases where the continental margin extends further than 200 mi, nations may claim jurisdiction up to 350 mi (482.8 km) from the baseline or 100 mi (161 km) from the 8,202-ft or 2,500-m depth, depending on certain criteria such as the thickness of sedimentary deposits. These rights would not affect the legal status of the waters or that of the airspace above the continental shelf. To counterbalance the continental shelf extensions, coastal states must also contribute to a system of sharing the revenue derived from the exploitation of mineral resources beyond 200 mi. These payments or contributions, from which developing countries that are net importers of the mineral in question are exempt, are to be equitably distributed among state parties to the convention through the International Seabed Authority.

The convention also contains a new feature in international law, which is the regime for archipelagic states (such as the PHILIPPINES and INDONESIA, which are made up of a group of closely spaced islands). For those states, the territorial sea is a 12-mi zone extending from a line drawn joining the outermost points of the outermost islands of the group that are in close proximity to each other. The waters between the islands are declared archipelagic waters, where ships of all states enjoy the right of innocent passage. In those waters, States may establish sea lanes and air routes where all ships and aircraft enjoy the right of expeditious and unobstructed passage.

The Convention on the Law of the Sea holds out the promise of an orderly and equitable regime or system to govern all uses of the sea. But it is a club that one must join in order to fully share in the benefits. The convention, like other treaties, creates rights only for those who become parties to it and thereby accept its obligations, except for the provisions that apply to all states because they either merely confirm existing customary law or are becoming customary law. The convention was adopted as a “package deal,” with one aim above all, namely universal participation in the convention. No state can claim that it has achieved quite all it wanted. Yet every state benefits from the provisions of the convention and from the certainty that it has established in international law in relation to the law of the sea. It has defined rights while underscoring the obligations that must be performed in order to benefit from those rights. Any trend toward exercis-

ing those rights without complying with the corresponding obligations or toward exercising rights inconsistent with the convention, must be viewed as damaging to the universal regime that the convention establishes.

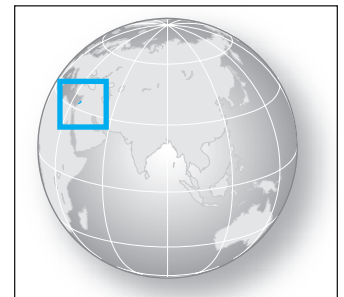
In the 21st century, the military aspects again became important. Now it is the right of a country's national defense to board and stop military cargoes to “rogue” nations or for use by terrorists. Coastal zones and CHOKE POINTS were no longer the primary focus of the Law of the Sea.

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## Lebanon

**Map Page** 1121 **Area** 4,015 square mi (10,400 square km) **Population** 3,727,703 **Capital** Beirut **Highest Point** 10,131 ft (3,088 m) **Lowest Point** 0 m **GDP per capita** \$4,800 **Primary Natural Resources** limestone, iron ore, salt, water, arable land.



LEBANON, ONE OF the world's smallest countries, is on the eastern shore of the MEDITERRANEAN SEA. SYRIA is its neighbor to the north and east, and ISRAEL is located to the south.

Although a small country, Lebanon has a wide range of geographical regions. All of the major cities are located on the coastal strip. The Mount Lebanon Range located inland, provides majestic peaks and ridges. The Bekaa Valley, located parallel to the coast, is home to a multitude of wine vineyards.

Thousands of years ago, the mountains of Lebanon were covered with great cedar forests. Only a few cedar forests remain, but Lebanon is still recognized as the most densely wooded country in the Middle East. Many pine trees cover the mountain land, and fruit trees are present all across the coastal plain. The mountains are home to many different birds, including ea-

gles, red kites, Sardinian warblers, and Scop's owls. The climate in Lebanon is as diverse as the topography. Along the coast, hot conditions are prevalent during the summer, and cool, moist weather during the winter months. Snow and wind are common in the Bekaa Valley during the winter, and the mountains provide a typical alpine climate year-round.

The French created Lebanon in 1920. Originally, the Maronites, the largest religious community in the country, were placed in control of the government. However, to ensure the Maronites would remain loyal to the French, the French enlarged Lebanon to include mainly Muslim areas in the state. After this inclusion, only 30 percent of the population was Maronite. The tight grip of the French would last for decades, and the religious differences would last for the rest of the century. In 1926, the constitution was passed; a single chamber of deputies was created that could elect a president. The president had limited authority to choose a prime minister and the cabinet. However, the French rule continued to control Lebanese foreign relations and the military. By 1936, French and Lebanese government officials signed a treaty that included a guarantee of fairness to all religious sects in the country. The Maronite Christian Emile Eddé was elected president and he chose a Muslim, Khayr al-Din al-Ahdab as the prime minister. This power sharing formula continued until the late 1980s.

The French left Lebanon after World War II, and for the next two decades, the Lebanese people tried to create a separate identity. In the early 1970s, many Palestinian Liberation Organization (PLO) fighters infiltrated the country. They conducted raids against the Israelis from southern Lebanon and urged many Palestinian refugees in Lebanon to fight for their cause. By April 1975, tensions reached new levels as civil war broke out in Lebanon. The conflict sided the Christian Maronites against the Muslim Lebanese National Movement (LNM). The Palestine Liberation Organization (PLO) soon joined the Muslim forces. One year later, the Syrian army intervened and, with Arab League support, worked out a cease-fire. By October 1976, an Arab Deterrent Force, mainly of 40,000 Syrian soldiers, occupied Lebanon. However, tensions were still high.

On June 6, 1982, after years of PLO attacks, Israel invaded Lebanon with the goal of eliminating the PLO and creating a 25-mile security zone in southern Lebanon. The Israelis bombarded Beirut, hoping the Christian militias would seize control of the government. By August 1982, the PLO evacuated Beirut and

took refuge in eight different countries. The Christian Bashir Gemayel was elected Lebanese president but was assassinated a few weeks later. The Israelis immediately returned to Beirut. A multinational peace force returned to the country and Amin Gemayel became president. In June 1985, Israeli forces withdrew from Lebanon, but maintained a presence in the southern Lebanon security zone. The country remained divided for the next six years. On May 22, 1991, the Lebanese government signed a Treaty of Cooperation and Brotherhood. Syria was given control over Lebanon's internal affairs and had around 16,000 troops stationed in the country. In 2005, under international pressure, Syria began to withdraw those troops.

Lebanon has attempted to pick up the pieces from the years of war. Muslims have been given a greater role in the government. Although the militant group, Hezbollah still retains its weapons, most of the militias have been weakened or eliminated. The Lebanese armed forces have central government control over the majority of the country and Israel had withdrawn its forces from the southern security zone.

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## leeward and windward

THE TERMS *leeward* and *windward* are used in a number of ways to describe specific places, physical features, and climatic processes. In one sense, windward and leeward generally refer to the location of a place relative to the prevailing wind direction. A windward location is one that is exposed to the prevailing winds. Conversely, a leeward location is protected from the prevailing wind.

For example, Concepcion, CHILE, on the west side of the ANDES would be in a windward location relative to westerlies moving inland from the PACIFIC OCEAN simply because it is exposed to the approaching wind. However, the east side of the Andes would be a leeward location because of the protection afforded by

the intervening mountains. The windward and leeward designations illustrated here are equally applicable to orographic lifting, the process involved when winds strike the front face of a mountain, are forced up the windward face of the mountain and then descend on the leeward side. If the winds are laden with moisture and the mountain is high enough, the moisture carried by the wind may condense and produce precipitation. The resulting precipitation will in the highest volumes on the windward side of the mountain and the leeward side will invariably receive a lesser amount.

There are a number of places in the world where this process is clearly evidenced. Among them are the moisture-laden westerlies reaching the Pacific coast of WASHINGTON, which are forced aloft by the Coastal Ranges. The windward side of this region receives an abundance of rainfall while the leeward side on the eastern slopes receives little or no rainfall. A classic example of orographic lifting is found in the HIMALAYAS when the summer monsoons bring warm, moist winds across the Indian subcontinent and are then forced aloft by the imposing Himalayan barrier. Areas on the windward side on the mountains may receive as much as 100 in (254 cm) of rainfall. However, because of the great heights of the Himalayas, little or no moisture reaches the leeward side. So within a relatively short distance the climatic results vary from near tropical conditions to the true deserts of Central Asia.

The terms are used in a more formal manner to name particular groups of islands. For example, the islands in the Lesser Antilles in the West Indies all lie in the pathway of the northeast trade winds. This wind belt moves from approximately 30 degrees north latitude toward the equator where it meets its counterpart from the Southern Hemisphere, the southeast trade winds. Historically, British sailing ships entered the region with the northeast trade winds at their backs. The first island encountered on these voyages was usually BARBADOS, the island farthest east and most to windward.

The Windward Islands, as they came to be called, include Barbados, the Caribbees (a cluster of small islands), DOMINICA, MARTINIQUE, GRENADA, SAINT LUCIA, and SAINT VINCENT AND THE GRENADINES. The Windward Islands, a former British colony, are the southernmost islands in the Lesser Antilles and were once collectively named the Federal Colony of the Windward Islands and later the Territory of the Windward Islands. The northern continuation of the Lesser Antilles includes islands that are farther downwind from the Windward Islands. First discovered by Columbus

in 1493, these are the Leeward Islands, which includes ANTIGUA AND BARBUDA, the British Virgin Islands, MONTserrat, SAINT KITTS AND NEVIS, and ANGUILLA. A string of leeward islands is also found northwest of the Hawaiian Islands, and this group has become a national bird sanctuary.

In addition, the Society Islands in French Polynesia, a region east of the COOK ISLANDS in the South Pacific, are identified as leeward islands. Reference may be made as well to another use of the word *windward*. The narrow sea-lane separating eastern CUBA and HAITI lies in the path of the northeast trade winds. As such, vessels traveling between the ATLANTIC OCEAN and the CARIBBEAN SEA are using the aptly named Windward Passage. Those traveling through the pass from northeast to southwest have the advantage of the northeast trade winds pushing them along.

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## Lena River

THE LENA RIVER is one of Russia's great northern rivers, draining an area of 899,641 square mi (2,306,772 square km) and encompassing a region rich in wildlife and natural resources, including one of the world's largest deposits of gold. This is also one of the most inhospitable regions on the planet, with extremes of temperature and vast stretches of northern forests (84 percent). Few people live in the region and there is only one city in the entire Lena basin, Yakutsk, the administrative seat of the former Yakut Autonomous Socialist Republic and now the capital of a semi-independent Yakutia, renamed the Republic of Sakha in 1991.

The river, 2,850 mi (4,597 km) long, flows mostly through Sakha, but its origins are in the Irkutsk District, immediately west of Lake BAIKAL. Its tributaries have their headwaters in the autonomous republic of Buryatiya and the districts of Chita, Amur, and Khabarovsk. The river starts in the Baikal range, only a short distance from the lake itself, though the lake's



waters flow into the Angara River and into the Yenisey, thousands of kilometers from the Lena. It then flows north and east to be joined by its first major tributaries, the Vitim and Olekma, whose headwaters originate in the Yablonov and other parallel mountain ranges east of Lake Baikal (which are also the source of the headwaters of the AMUR RIVER).

The river then turns again north in a large arc, following the contours of the Aldan Plateau to the south, from which emerges the Lena's largest tributary, the Aldan, and the Verkhoyansk Range to the east. This range of mountains forms a steep escarpment for over 600 mi (1,000 km), stretching all the way to the Lena's delta on the Laptev Sea, an arm of the ARCTIC OCEAN. This semicircular area bounded by the Aldan and Verkhoyansk highlands forms a sort of climatic vortex, producing some of the coldest temperatures ever recorded on the planet: -88.9 F (-67 degrees C).

To the west the terrain is much flatter, with larger tributary rivers, notably the Vilyui, which extends far into the Siberian Plateau. From the confluence of the Lena with the Aldan, 800 mi (1,300 km) from the sea, the river becomes very broad, sometimes reaching 5 mi (8 km) across. The delta, covering 12,352 square mi (31,672 square km), is the largest in RUSSIA and third largest in the world. It is formed of numerous islets, marshes and sandbars. The largest islands (hundreds of square kilometers) are covered with damp, mossy tundra and frozen lakes that do not permit the construction of roads, so travel between the eight permanent settlements continues mainly by dogsled.

The river is almost entirely navigable, with an abundance of fish, but is frozen eight months of the year. Ice has been measured at 53 in (136 cm) in the south, and up to 90 in (231 cm) at the delta. Because the Lena is almost entirely fed by mountain snows, spring thaws can bring disastrous floods, followed by equally breakups of river ice, sizable chunks of which can destroy entire sections of the riverbank and any settlements alongside it. The annual flow of the river is very irregular, with 90 to 95 percent of all of its discharge in spring and summer, when its volume increases by as much as 10 times that of the winter months. This irregular flow has limited the development of hydroelectric projects in the Lena basin, though there are two large dam-reservoir complexes on the Vilyuy. The Lena was used as a highway for trappers and traders in Russia's expansion to the Pacific coast, with its main town of Yakutsk founded in 1632.

Russia's relations with the indigenous Yakut and Evenki peoples were not always harmonious, and the

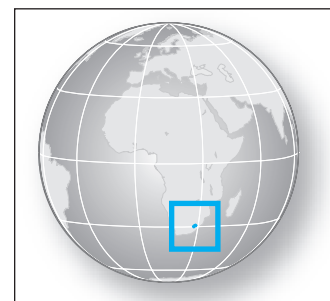
region saw a good deal of oppression, lawlessness, and unbridled greed in the race for lucrative furs. Another boom period followed in the 19th century, with the discovery of gold in the Lena valley near the confluence with the Vitim River. Privatization since the 1990s has returned the region to its "Wild West" frontier days, ruled by hustlers, speculators and black marketers. The 1 million inhabitants who live in the Lena basin are looking to their mineral wealth, still undeveloped because of great distances, difficulties building roads and buildings on permafrost, and difficulty getting water half the year.

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## Lesotho

**Map Page** 1116 **Area** 11,720 square mi (30,355 square km) **Population** 1,861,959 **Capital** Maseru **Highest Point** 11,425 ft (3,482 m) **Lowest Point** 4,265 ft (1,301 m) **GDP per capita** \$550 **Primary Natural Resources** water, diamonds, minerals.



**LESOTHO IS LOCATED** literally within **SOUTH AFRICA**: This small southern African country is landlocked and surrounded on all sides by the Republic of South Africa. Lesotho covers an area slightly smaller than **MARYLAND**.

It is the only country in the world that lies entirely above 3,280 ft (1,000 m) and more than 80 percent of Lesotho is 5,905 ft (1,800 m) above sea level. Lesotho is mainly mountains, hills, and highlands with plateaus. It has a very temperate climate, with cool to cold dry winters and hot, wet summers.

Lesotho has four major mountain ranges within its borders. The **DRAKENSBURG MOUNTAIN** range, the **Central** range, and the **Thoba Rutsoa** range are all in the

central and eastern parts of Lesotho and the Maloti range is in the western region. Thabana-Ntlenyana is the highest peak in all of southern Africa. It is also called “The Kingdom in the Sky,” “The Roof of Africa,” and “The Switzerland of Africa.” Deep river valleys and canyons cut these mountains; the water that flows through these canyons is the major water supply for all of southern Africa. Many of the rivers on the southern part of the African continent start in these hills, including the Orange River and its many tributaries. This water is Lesotho’s main natural resource.

Lesotho is exploiting its water through the Lesotho Highlands Water Project. This project is designed to capture, store, and transfer water from the Orange River system and send it to the Republic of South Africa. This project not only moves water but produces hydroelectricity as well. There are going to be approximately seven dams and two tunnels when the project is complete in 2020. With the first phase of the project already completed, Lesotho has become almost completely self-sufficient in the production of electricity. Already it has generated approximately \$24 million annually through the sale of electricity and water to South Africa.

The kingdom of Lesotho is heavily populated especially in the western part of Lesotho where there is more arable land. There, the people raise crops of corn, sorghum, wheat, beans, peas, asparagus, tomatoes, and peaches. Most of the land is used for raising animals such as sheep, goats, cattle, pigs, chickens, and horses. These people, called the Basotho, are remnants of various ethnic groups made up mainly of various Bantu-speaking people and some of the original San or Bushmen who were Lesotho’s earliest inhabitants. The Basotho managed to fend off both the Zulus and the Boers in the 1800s.

On October 4, 1966, Lesotho gained independence. The Lesotho government is now a constitutional monarchy with a king as the head of state and a prime minister as the head of government. Currently, the king serves primarily as a ceremonial figure with no executive power. However, all land in Lesotho is held by the king and is allocated to the Basotho people through local chiefs. Foreigners in Lesotho are strictly forbidden from owning land. Lesotho has one of the highest literacy rates in Africa; official languages are English and Sesotho, a Bantu language.

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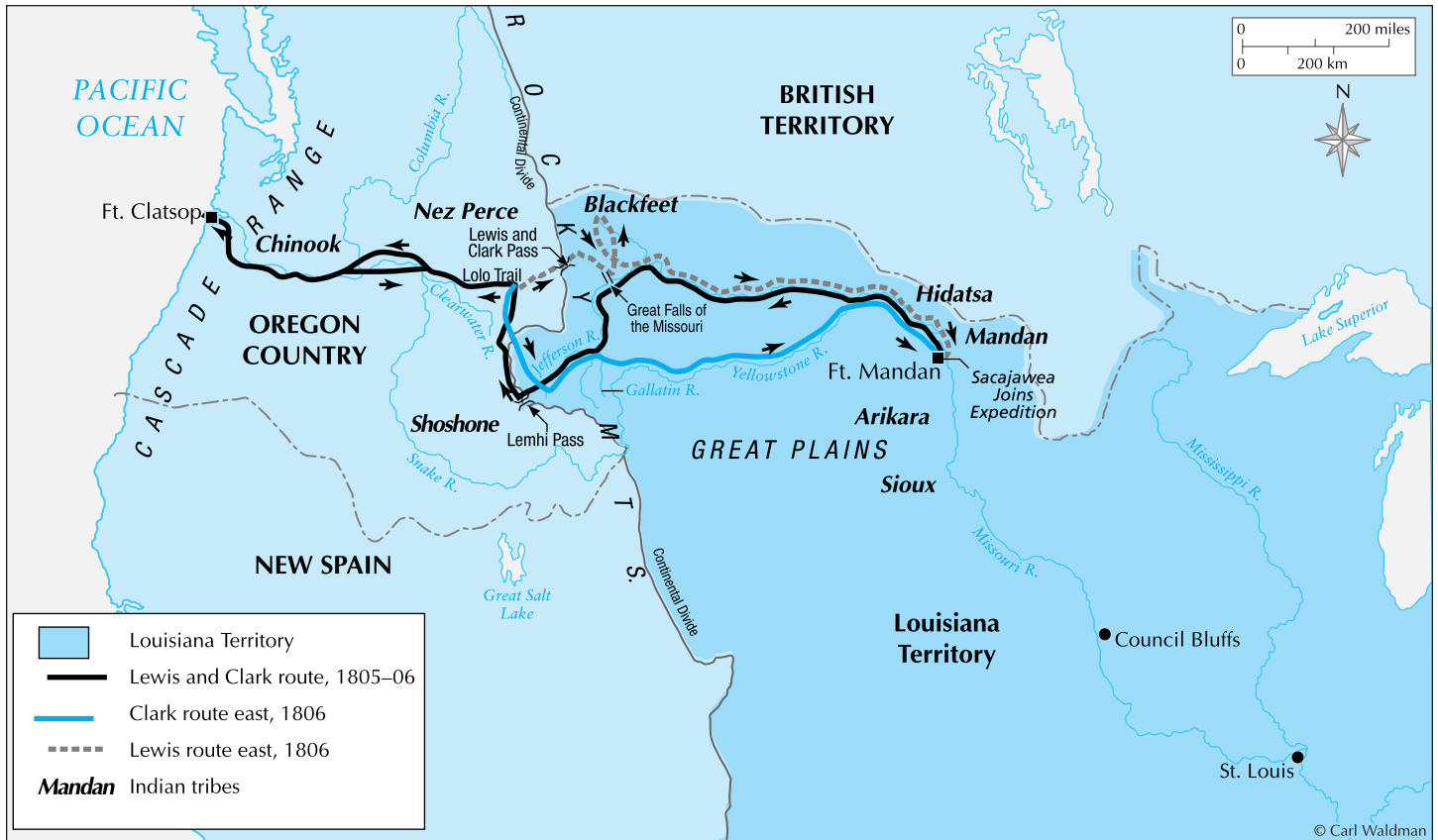
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## Lewis and Clark

IN 1804, MERIWETHER Lewis and William Clark began an expedition across the newly acquired LOUISIANA PURCHASE territory. These two army captains were chosen by the American president, Thomas Jefferson, to explore new land the UNITED STATES had purchased from FRANCE one year earlier, and to find a direct water route across the nation. For a little over two years, Lewis and Clark led their corps through some 8,000 mi (12,800 km) of unexplored lands, acquiring scientific samples, creating maps, and conveying to the local Native Americans that an acquisition of their territory by the United States had just occurred.

The idea of an expedition into the Louisiana Purchase territory began in early 1803 after approval by the U.S. Congress. Lewis, the personal secretary and friend of Jefferson, was chosen to lead the expedition. Lewis entered the army in 1794, where he served in the Frontier Army and rose to the rank of captain. He possessed quality leadership, scientific, and cartography skills, which contributed to the goals of the expedition. In June 1803, Lewis wrote a letter to his friend, Clark, expressing his desire to lead the expedition with him, as well as to recruit volunteers. Lewis had previously served under Clark during the latter half of the 1790s, and he viewed Clark as an able-bodied and highly intelligent leader.

Clark accepted the proposal, and in the middle of October 1803, he met Lewis in Clarksville, in the Indiana territory. The two men began preparations and enlisted men for their new Corps of Discovery. Two months later, the crew was in St. Louis, MISSOURI, making final preparations for the journey. After a winter of training their corps and stocking up on goods and materials, Lewis, Clark, and the Corps of Discovery embarked on their exploration on May 14, 1804. Lewis and Clark proved to be adept at leadership, and each used individual skills to the advantage of the group. Lewis was the planner and scientist. He proved his strength and stamina when he saved himself from a fall



By September 1806, after a successful completion of the expedition, Lewis and Clark returned to St. Louis with careful descriptions of newly discovered animals and plants. Overall, they had accumulated a complete and impressive journal of their experiences.

off a cliff by wedging his knife into a crevice and breaking the fall. He cured a case of accidental poisoning through a homemade remedy. Lewis even survived an accidental gunshot wound from one of the corps members.

Clark proved to be a fine boatman and navigator as well as a skillful cartographer throughout the journey. His first map was made during their 1804-05 winter's stay at Fort Mandan. He used the knowledge obtained from traders and natives to create a map of the upper Missouri and Mississippi rivers region. He also created a skillful map of the Great Falls of the Missouri with references to botanical features. This map would continue to be used by expeditionary forces years later.

By September 1806, after a successful completion of the expedition, Lewis and Clark returned to St. Louis with careful descriptions of newly discovered animals and plants. Overall, they had accumulated a complete and impressive journal of their experiences. Lewis wrote letters to Jefferson that spoke of a triumphant exploration and of the discovery of a naviga-

ble route across the continent, which included stretches of the Missouri and Columbia rivers. His letters spoke of the difficult conditions, but also of the profitable fur trade that was occurring and the abundant animals that occupied the area. Although a direct water route across the continent did not exist, Jefferson was extremely impressed with the exploration.

After returning to their families, Lewis and Clark traveled separately to Washington, D.C., to receive their pay and honors. Each received double pay for service, which amounted to \$1,228, and a title to 1,600 acres of land. Lewis was named governor of the Territory of Upper Louisiana, and Clark was made brigadier general of militia and superintendent of Indian Affairs for the Territory of Upper Louisiana.

In 1808, Clark married Julia Hancock of Fincastle, Virginia, and became a business partner of the Missouri Fur Company. This company was to send militia, hunters, and boatsmen into the newly explored territory and to implement the fur trade. Lewis, however, did not thrive with similar success. His effort to get his and Clark's journals published proved unsuccessful; he

had a couple of failed attempts at marriage; and his friendship with Jefferson floundered as he became more dependent on alcohol. By March 1808, Lewis finally traveled to St. Louis to work as governor.

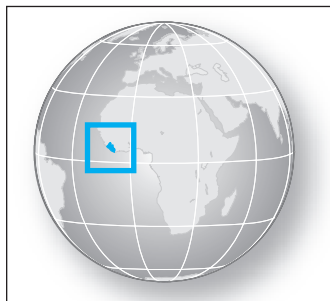
By September 1809, after many problems in administering his duties with his constituents, Lewis left for Washington, D.C., to ask for help. However, his problems seemed too large, and Lewis committed suicide in a roadhouse along the Natchez Trace near Nashville, Tennessee. Upon hearing the news, Clark traveled to Washington, D.C., to grieve with Lewis's family. Afterward, he traveled to Philadelphia, Pennsylvania, where he arranged for the rewriting of his and Lewis' journals. By 1814, the journals were finally published, with remarkable maps, but few of the explorer's scientific discoveries. Remarkably, the American public exhibited little interest in the journals, and few copies were sold. It was not until new editions in 1893 and 1904–05 that the journals finally became popular. In 1813, Clark was named governor of the Missouri Territory. He spent the remaining years of his life meeting and creating lasting friendships with Native Americans, traders, and trappers. Through these encounters, Clark was able to update his map of the West. In 1838, Clark died of natural causes.

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## Liberia

**Map Page** 1113 **Area** 43,000 square mi (111,370 square km) **Population** 3,317,176 **Capital** Monrovia **Highest Point** 4,540 ft (1,383 m) **Lowest Point** 0 m **GDP per capita** \$1,000 **Primary Natural Resources** rubber, coffee, cocoa, timber.



LIBERIA, "LAND OF THE FREE," in western Africa, borders the north ATLANTIC OCEAN, between CÔTE D'IVOIRE and SIERRA LEONE. It has 10 to 50 mi (16 to 80 km) of flat coastal plain that contains creeks, mangrove swamps, and lagoons. Beyond that, forested hills, from 600 to 1,200 ft (180 to 370 m) high cover the rest of the country, excluding the mountains in the northern highlands. The maximum peak in the Nimba Mountains is 4,540 ft (1,383 m). Six principal rivers flow to the ATLANTIC OCEAN.

Vegetation is predominantly forest, and the tropical, humid climate sees rainfall averages of 183 in (465 cm) on the coast and 88 in (224 cm) in the southeast. The dry season (harmattan, December and January) splits two rainy seasons. Cities other than Monrovia are the ports of Harper and Buchanan.

### POPULATION GROUPS

There are 16 ethnicities in Liberia, including the Kpelle, Mano, Baso, Grebo, Kru, and Vaj. Seventy percent are native, traditional religion practitioners, while 20 percent are Muslim and 10 percent Christian. Although English is the official language, the native languages are used commonly. The Americo-Liberians, a minority residing in the cities, tend to be Protestants. Other population groups include Lebanese merchants and European and American technicians.

Liberia was founded in 1820 on the Grain Coast; it was the gift of the American Colonization Society, which received it from the Cape Mesurado chiefs. The founders fought bloody battles with the indigenous peoples. Eighty-six freed slaves from the United States established Christopolis, later Monrovia, in February 1820. Approximately 15,000 freed slaves emigrated from the United States until the American Civil War. In 1847, Liberia declared itself an independent republic.

Until 1980, the Americo-Liberian or True Whig Party (TWP) ruled Liberia. The first president was Joseph Jenkins Roberts, American-born. The government and constitution were modeled on that of the UNITED STATES. The republic traded with other parts of West Africa, but it modeled its style of living on those of the United States.

Modernization efforts led to a crisis of foreign debt in 1871. Conflicts with FRANCE and Britain led to losses of territory in 1885, 1892, and 1919. Liberia used the European rivalries and the support of the United States to remain independent. Still its exports declined and its debts rose, leading to foreign interference. Bankruptcy came in 1909. International loans saved Liberia. In 1926, Firestone, the American tire company, leased



large rubber plantations. In 1930, the League of Nations investigated charges that Liberia was exporting labor, that is, engaging in the slave trade. The president resigned.

The new president, William Tubman, opened the country to international investment, allowed indigenes greater participation, and allowed the exploitation of iron and other minerals. Education, roads, infrastructures, and healthcare were improved. Tubman died in 1971. His vice president, W.R. Tolbert took over. A proposed increase in the price of rice in 1979 set off rioting.

The TWP's rule ended on April 12, 1980, when Master Sergeant Samuel K. Doe, a native Krahn, pulled off a successful coup. Doe's forces executed Tolbert and several other Americo-Liberians. Doe's People's Redemption Council promised a return to civilian rule, then began repressing the opposition and abusing human rights. Doe instituted constitutional changes, survived numerous coups, and saw flight of thousands of refugees to the Côte d'Ivoire. The refugees returned in 1989, led by Charles Taylor. The war waxed and waned until finally in 2003 the Taylor regime ended, and the country and government struggled to maintain the uneasy truce.

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## Libya

**Map Page** 1113 **Area** 679,362 square mi (1,759,540 square km) **Population** 5,499,074 **Capital** Tripoli **Highest Point** 7,437 ft (2,267 m) **Lowest Point** -154 ft (-47 m) **GDP per capita** \$7,600 **Primary Natural Resources** crude oil, petroleum products.



A RELATIVELY LARGE country, similar in size to the state of ALASKA, Libya largely consists of broad rolling deserts, barren rock inselbergs and immense dune fields or ERGS. It is a landscape of sandstorms; hot dusty wind, or ghibli; an expanding desert; and scarce water. More than 90 percent of the country is considered arid or semiarid. Its primary cities are all located on the MEDITERRANEAN SEA coastline, which has facilitated its links across North Africa to Europe and western Asia.

Generally speaking, the Saharan plateau covers most of Libya. The exceptions are in the northwest corner in a region known as Tripolitania and in the northeast in Cyrenaica, Libya's largest region. The Tripolitania region, which runs north to south, is a string of carefully cultivated coastal oases in addition to the triangular Al-Jifarah plain, and the Nafusah Plateau, 200 mi (320 km) of limestone between 2,000 and 3,000 ft (600 to 915 m) in elevation.

Libya has no perennial rivers, but there are extensive underground aquifers that support artesian wells and springs. Libya's arid desert climate is moderated along the coast by the Mediterranean Sea. Precipitation ranges from 16 to 20 in (40 to 50 cm) in the northern hills to less than 5 in (12 cm) throughout most of the south, and to 1 in (2.5 cm) in the Libyan Desert. Droughts are common, meaning natural vegetation is minimal. Libya's principal mineral resource is its reserves of petroleum, Africa's largest and among the world's largest.

Since its earliest days as a major Phoenician and Roman territory on the North African coast of the Mediterranean Sea, Libya has been raided and colonized by Vandals, Arabs, Ottoman Turks, and Italians until its independence in 1951. Only a few years later, the country changed dramatically with the discovery of enormous oil reserves. In 1969, a 27-year-old Muammar Qaddafi led a successful coup to gain control of the nation. Qaddafi has been victorious in removing any imprints of previous cultures to create a landscape from his own vision. Based upon his Third International Theory, he created a political system combining Islam and socialism.

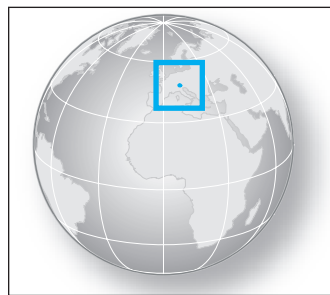
Using petroleum revenues in the 1970s and 1980s to promote political ideologies (including supporting terrorist activities) throughout the region, Libya prompted the United Nations (UN) to impose economic sanctions after the Lockerbie terrorist bombing was suspected to have had Libyan ties. The sanctions were then lifted in April 1999 when Qaddafi handed over Lockerbie bombing suspects.

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## Liechtenstein

**Map Page** 1131 **Area** 62.4 square mi (160 square km) **Population** 33,145 **Capital** Vaduz **Highest Point** 8,577 ft (2,599 m) **Lowest Point** 1,419 ft (430 m) **GDP per capita** \$25,000 **Primary Natural Resources** hydroelectric potential.



ONE OF WESTERN Europe's five microstates, the story-book principality of Liechtenstein is in reality one of the few "absolutist" states in the world, thanks to a favorable referendum voting extensive powers to the ruling sovereign in March 2003. His Serene Highness, Prince Hans-Adam II von und zu Liechtenstein now has more political prerogatives than any other monarch in Europe.

Sandwiched between the Swiss cantons of St. Gallen to the west and Graubünden to the south and the Austrian province of Vorarlberg to the east, Liechtenstein's history has naturally been closely linked to its larger neighbors. The family had served the Habsburgs in AUSTRIA for centuries, and in fact the family derives its name from its main castle just south of Vienna. Prince Johann Adam bought the county of Vaduz and the adjacent lordship of Schellenberg in 1699 and 1712, and the two territories were united as a fully independent member of the Holy Roman Empire in 1719. But the land itself was of secondary importance to the family: no sovereign prince of Liechtenstein even visited until the middle of the 19th century.

When the Holy Roman Empire fell apart thanks to Napoleon in 1806, Liechtenstein fell between the cracks and was not consolidated into one of the larger German states. Successive princes maintained their independence and forged a beneficial customs union with Austria in 1852. After the collapse of the Austro-Hun-

garian Empire, however, the princes turned west and formed a similar customs and monetary union with SWITZERLAND in 1923, which is still in effect today. The princely family still owns large estates in Austria and lays claim to numerous others in the CZECH REPUBLIC that were confiscated by the communists (equal to ten times the size of the principality itself). Still, the prince's wealth is estimated at more than \$2 billion.

The principality—15 mi (26 km) long, and an average of 4 mi (6 km) wide—lies on the eastern bank of the RHINE RIVER, between its emergence from the high Alpine valleys of Switzerland and Lake Constance to the north. Two canals running on either side of the river through this valley maintain its water levels to reduce risk of spring floods. The eastern third of Liechtenstein is divided from the rest by a range of mountains, forming the upper Samintal, or valley of the Samina River, which runs northward into the Ill in Austria, which in turn joins the RHINE just a few kilometers north of Liechtenstein. To the east and south of this valley rise the much greater Alpine heights dividing the country from Austria, including a number of peaks above 8,250 feet (2,500 m).

The main town, Vaduz, has a population of about 5,000. High above the town, the prince's castle, dating from the 14th century, boasts one of the largest private art collections in the world and is a major tourist attraction. Much of this art collection has recently been transferred to Vienna's newest major art gallery, the restored Liechtenstein Palace, opened to the public in March 2004. Liechtenstein itself has been transformed since World War II from a sleepy agricultural community to a modern industrialized society with one of the world's highest standards of living.

Revenue is generated locally through skiing and the sale of rare stamps, but it is the income from numerous so-called post-office-box companies, attracted by low business taxes, that has boosted the national economy (providing as much as 30 percent of state revenues). Concerns over tax evasion schemes and money laundering, however, have recently caused increased pressure from the EUROPEAN UNION and the principality's authorities.

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## Lisbon

WITH A metropolitan-area population of 2,682,687, Lisbon is the capital and largest city in PORTUGAL. It is located on the right bank of the Tagus River, where it forms a large estuary providing a natural safe harbor close to the ATLANTIC OCEAN. The city evolves over a series of hills and enjoys a Mediterranean climate, with mild winters and warm dry summers.

Lisbon was the capital of a worldwide empire for more than 400 years and is the main political, economic, and cultural center of Portugal. The origin of the settlement is remote. Occupied by the Romans in 205 b.c.e., the town was confined to old Castle Hill and the slope leading to the river. It was conquered by the Moors in 714 and recovered by the Crusades and the king of Portugal in 1147. Lisbon was promoted to capital of the kingdom in 1255, and thanks to commerce between the Mediterranean and northern Europe, it became a primary urban center during the 13th and 14th centuries.

Serving as base for the Portuguese expeditionary navies in the age of discoveries, the city benefited the most from this period and became a significant cultural and economic center: infrastructures and especially monuments were built, and the city expanded to the west. In 1527, Lisbon already stood out among Portuguese cities and gained importance at a European level. An earthquake in 1755 destroyed most of the city. The downtown area (Baixa) was rebuilt as a regular grid aligned with the river, replacing tortuous medieval streets and turning it into a hallmark of Lisbon for its unity and architectural value.

Until the development of railroad transportation, the river was the main thoroughfare for the transport of people and goods between the city and more interior areas of the country. During the 19th century industrialization, mass transit was introduced and larger factories were installed along the river, attracting peasants from the countryside and originating typical worker neighborhoods. At the end of that century, the opening of Avenida da Liberdade, a wide boulevard, changed the form of the city by directing growth toward the north. However, by 1940 Lisbon was still concentrated and close to the river. On the hill to the west, the 2,540-acre (1,028-hectare) Monsanto forest park was created on still undeveloped land.

After World War II, a sharp increase in urbanization pushed growth beyond the limits of the municipality, and toward the west and north along main transportation routes (especially railroads). Population



*Eduardo VII Park in Lisbon recalls the glory days when Portugal was a major colonial power across the world.*

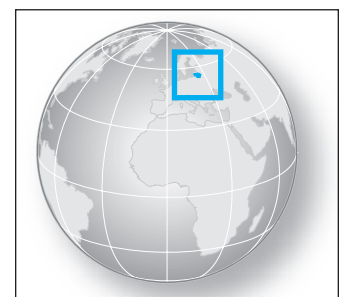
of the city stabilized in the 1950s, and by 2000 only 20 percent of the population of the metropolitan area lived within city limits. In the 1950s and 1960s, new industrial areas were located in Cabo Ruivo and on the south bank, connected by a bridge in 1966. More recent transformations include the expanding network of expressways and construction of large peripheral shopping centers, underlining the ongoing strong suburbanization. Part of the east riverfront was rebuilt to replace heavy industry with an area of residential use.

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## Lithuania

**Map Page** 1130 **Area** 25,173 square mi (65,200 square km) **Population** 3,592,561 (2003) **Capital** Vilnius **High-est Point** Juozapine/Kalnas 954 ft (292 m) **Lowest Point** 0 m **GDP per capita** \$8,400 **Primary Natural Resources** peat, arable land.





THE REPUBLIC OF Lithuania in northern Europe is a lowland country that borders LATVIA to the north, BELARUS to the east and southeast, POLAND and the Russian enclave of Kaliningrad to the southwest, and the Baltic Sea to the west. Lithuania is a parliamentary democracy with the supreme council or Seimas serving as the legislature and the president serving as head of state. Its major cities are Vilnius, Kaunas, and Klaipėda.

The Lithuanian countryside consists of lowlands and small hills and is dotted by 3,000 lakes. The climate is generally humid, with peak rainfall in August. Temperatures range from 23 degrees F (-5 degrees C) in January to 63 degrees F (17 degrees C) in June. The chief river is the Nemunas, which flows to the Baltic Sea.

Permanent human settlements in what is now Lithuania date to about 8000 B.C.E. In the 13th century, the Teutonic Knights were sent to Lithuania to convert the pagan population to Christianity. In 1385, Grand Duke Jogaila married Queen Jadwiga of POLAND, which began the Christianization of Lithuania and its special relationship with Poland. In 1569, the Treaty of Lublin joined the Grand Duchy of Lithuania and the Kingdom of Poland into a Polish-Lithuanian Commonwealth to balance the growing power of Moscow. Thereafter, Lithuania joined Poland's decline, ultimately culminating in the partitions by AUSTRIA, Prussia, and RUSSIA between 1772 and 1795.

Lithuania was incorporated into the Russian Empire after the final Polish partition in 1795. The population was subjected to harsh policies forbidding use of the Lithuanian language, resulting in revolts in 1830 and 1863. In 1918, Lithuania declared its independence amid the destruction and chaos of World War I and the Russian Revolution. In August 1939, the Molotov-Ribbentrop Pact split Poland and the Baltic States between the Soviet Union and Nazi Germany. In 1941, the Nazis invaded Lithuania, only to be reoccupied by the Soviet Union. After World War II, Lithuania was incorporated into the Union of Soviet Socialist Republics.

In 1991, Lithuania regained its independence with the other Baltic States. The last Soviet troops withdrew from Lithuanian soil in 1993. Like its Baltic neighbors, Lithuania has taken steps to integrate into Europe by joining the NORTH ATLANTIC TREATY ORGANIZATION (NATO) in 2003 and the EUROPEAN UNION in 2004.

Lithuanians make up 80 percent of the population, with the remainder consisting of Russians, Poles, and Belarussians. Roman Catholicism is the religion prac-

ticed by the majority of Lithuanians. After the demise of the Soviet Union, the state of Russians residing since the Soviet era poses a challenge for Lithuania.

The Lithuanian economy has had to transform from a command economy under the control of Moscow to a free market economy. This process has been successful in bringing prosperity but has also created inequities in the standard of living. Lithuania's chief exports are meat, milk, dairy products, and television parts, while remaining dependent on oil and natural gas from Russia.

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## littoral

THE WORD *LITTORAL* comes from the Latin root *littus*, or "seashore." The littoral zone of a lake or ocean refers to the shallow waters closest to shore. In lakes, this is the zone dropping from the shoreline to roughly 10 ft (3 m) deep where there is enough sunlight for rooted plants to exist. Only in lakes with strong wave action will the littoral zone have algae instead of rooted plants.

Since the littoral zone is the interface between the lake and the surrounding watershed, it receives and accumulates sediment and nutrients that can support a wide variety of plants and animals. Plants include emergent wetland vegetation to submergent plants that may or may not reach the lake surface. This vegetation provides nutrients and habitat for fishes, birds, amphibians, invertebrates, and zooplankton.

Because of tides and wave action, the littoral zone of an ocean is subdivided into many parts. The supralittoral zone (spray zone) is found above the high tide mark up to the point that ocean spray cannot reach. This area usually receives only ocean spray, except for very high tides or storm surges that can inundate it. The intertidal littoral zone is bordered by the high and low tide marks. The sublittoral zone starts at the low tide mark and goes out to roughly 650 ft (200 m) deep, which is the average depth of the edge of the continental shelf. Numerous species live in these zones,



each adapted to the abundance and presence of water they receive each day.

Littoral zones are the interface between land and water, and so they are very productive, meaning they support many plants and animals. However, these same areas are also easily altered by human development or pollution. For example, more people in the UNITED STATES are building homes on the remaining edges of lakes and rivers. Disturbing the soil to grade the lot and build the house causes erosion, which moves sediment into the water. Often, people will dump a load of sand on the littoral zone so that they don't have to walk through plants to go swimming and so it will look neater. Piers built off of these lots can also damage the plants in the littoral zone. As houses age, septic systems start to fail and this nutrient-rich pollution moves laterally into the water, promoting eutrophication. Polluted runoff from driveways and lawns can also impair the waterways.

Coastlines in every country have been feeling additional pressures from growing cities. The more human activity near a coastline results in more damage to the littoral zone. In wealthier areas, beach replenishment (dumping new sand on the beach) buries the current plants and animals, and the building of seawalls and groins to protect one beach will disturb currents to more seriously erode the next unprotected beach downcurrent. The major problem, however, is pollution. Sewer pipes and polluted rivers both dump myriad pollutants into the littoral and sublittoral zones, damaging the life forms there.

Sometimes people hear about this type of pollution when local health departments close down shellfish beds after sewage pollution has been high (because of storm sewer overflows or treatment plant malfunctions). Similarly, each year more beachgoers arrive to find beaches closed where water quality monitoring has detected pathogens, particularly after rain events. Surfers on the west coast of the UNITED STATES have long complained of intestinal sickness and skin sores after spending time in the water near sewage and creek outfalls. There is increasing pressure on coastal cities to repair and upgrade their aging treatment facilities to solve this problem.

Other laws now prevent ocean liners from dumping their sewage (treated or not) near shore, and only to dump treated sewage many miles out to sea. In some countries, laws require that ships not dump their waste oil or oily bilgewater close to shore or that only double-hulled oil tankers may enter port. Degrading littoral zones, particularly along oceans, damages habitat

that marine and shorebird animals need, thus reducing this common resource both regionally and globally. The LAW OF THE SEA expects that signatories respect and protect these areas, but oftentimes little or no protection exists.

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## Ilanos

ALSO KNOWN AS the Orinoco River plains, the llanos of COLOMBIA and VENEZUELA are the northernmost section of the central lowlands of South America. The llanos are formed by a large geologic depression that once was an arm of the sea. This location is an alluvial basin between the northern ANDES MOUNTAINS and the Guyana Highlands. The region is generally very level, with a largely featureless landscape. Most of the llanos is tropical grassland, with some woodlands along the rivers.

The Orinoco River borders the Venezuelan llanos to the south. Shallow depths, rapids, and waterfalls limit travel along the river. In the 1950s, Venezuela dredged the river, opening it to larger ships that could reach Ciudad Guayana. The Guaviare River, a tributary of the Orinoco, marks the southern border of the Colombian llanos.

The lives of inhabitants of the llanos are regulated by rainfall that swell the region's rivers and flood the plains. The rainy season is from April to November, with June through August generally the rainiest months. During this rainy season, the region's grasslands turn green and grow quickly. During the dry season from November to March, rivers and lakes diminish, trees shed their leaves, and vegetation is covered with dust. Early in the dry season, stagnant pools remain, which traditionally have been breeding grounds for disease-carrying mosquitoes. Later, even these pools dry up completely, leaving a hard, sunbaked landscape. Grazing land is often scarce during the dry season and animals are sometimes short of

water. This drought-flood cycle has traditionally limited farming in the llanos. There have been some attempts at flood control and irrigation, such as along the Guarico River in Venezuela.

After the Spanish conquest of the coastal regions of South America in the 16th century, many Native Americans fled to the llanos. Soon, a llanero culture emerged that mixed native, Spanish, and African traditions. The economy came to depend on horses and cattle, as the Spaniards released these Old World animals into the wild. The animals roamed the plains with only limited supervision. Before the 19th century, there was no systematic animal husbandry. The semi-nomadic llaneros drove the animals to upland basins near the coastal and Andean cities for slaughter. Because the llanos were isolated, most of the meat was for local consumption. Hides were for both local consumption and export. Since the livestock was not part of international trade, there was little scientific breeding until the mid-20th century.

The llanos played an important role during the Spanish colonies' wars of independence in the early 19th century. Llaneros made excellent cavalymen. They generally fought more for concrete material goals rather than abstract political ideals. At first, they fought for the Royalist side from 1813 to 1814. Later, many plainsmen joined with the llanero Patriot José Antonio Páez, who had joined with Simón Bolívar, the most important independence leader.

The llanos continued to be a largely pastoral region after Colombia and Venezuela achieved independence. Low population and limited economic activity predominated until World War II. In the postwar period, oil and gas deposits near El Tigre, Venezuela in the eastern llanos changed the region's economic focus. Also, Ciudad Guayana along the Orinoco River at the southern edge of the llanos grew into an important industrial center of more than 500,000 people. An example of growth pole industrialization popular in Latin America during the mid-20th century, Ciudad Guayana has become one of South America's leading steel, aluminum, and heavy manufacturing centers.

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## loess

LOESS (PRONOUNCED "LUSS") is a very fine light soil, often buff, yellow, or gray in color. The word stems from the German word *löss* or "loose," and loess is generally easily eroded by water or blown by wind. Major loess deposits are found in Shaanxi, CHINA, in some of the U.S. plains states, notably western IOWA and western NEBRASKA, and some parts of Europe, such as central BELGIUM. Loess can mix with other soil types, yielding categories such as loess, sandy loess, and clayey loess.

Recent scientific studies suggest that many of the world's loess deposits previously believed to have been transported by water were actually wind-blown (eolian) in origin. In North America, the process began during the last Ice Age, as glaciers ground rock into a fine, flour-like sediment. As temperatures rose and the glaciers melted, the "flour" was deposited on flatter terrain, where it was later blown to its current locations by the wind.

China's loess deposits are the world's thickest and most ancient. Rather than glacial dust, most of these deposits of loess soil are believed to have originated in the vast deserts of Central Asia, and to have been deposited by the wind on China's Loess Plateau, an area the size of FRANCE centered on Shaanxi Province in north central China. China's Loess Plateau has an average thickness of 492 ft (150 m), and reaching 1,082 ft (330 m) near Lanzhou on the western edge of the plateau. China's second-longest river, the HUANG (Yellow) has its headwaters on the plateau and takes its name from the color of the loess sediment it carries downstream. Some of these deposits have been dated to more than 2 million years old. Loess deposits in the Yellow River valley have historically been easily tilled with simple wooden tools, and archaeologists suggest this relates to why the birthplace of Chinese civilization is found in these areas, centered upon the ancient capitals near Xian and Loyang.

Loess also gives the Yellow River its characteristic color, and its reputation as the "sorrow of China." As much as 1,600 tons of loess a year is carried downstream by the Yellow River, which has silt content measuring as high as 98 times that of the muddy MISSISSIPPI. When the river slows on the floodplains of central and coastal China, the loess is redeposited. Since the riverbank in these heavily populated areas is much higher than the surrounding land, disastrous floods have been a common occurrence throughout Chinese history.

Today, China's government is struggling not only to control floods downstream, but also to deal with some of the world's most severe soil erosion on the Loess Plateau, home to a population of about 40 million.

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## Loire River

TO MANY PEOPLE, the Loire River defines FRANCE. It is the country's largest river and draws together its different regions, east and west, north and south. The Renaissance chateaus along its lower course are the second-largest tourist draw after Paris, and the river provides water and transportation for the nation's agricultural center.

From its origins in the remote peaks of the Cévennes in southeastern France to its wide estuary on the Bay of Biscay, the river crosses through, or forms the border of, 13 departments and crosses six historic regions, from Languedoc to Brittany. Seven cities with populations greater than 100,000 are included in its watershed (Orléans, Tours, Angers, and Nantes on the river directly, and Clermont-Ferrand, Limoges, and Le Mans on tributaries). The Loire flows for 627 mi (1,011 km), draining a watershed of 44,956 square mi (115,271 square km), one-fifth of France.

It is the last "wild river" of Europe, with no dams on its main course, and several of those that have been built on tributaries were recently destroyed under a government initiative, Plan Loire Grandeur Nature. This program has set aside funding for 2000 through 2006 to secure the river basin from floods, to regulate the production of nuclear and hydroelectric power, and to restore the region's natural habitat, notably its spawning grounds for Atlantic salmon, whose numbers

have decreased over the last century from hundreds of thousands to mere hundreds.

Recognizing the importance of the lower valley's natural and historic beauty to the nation's economy, the government also heavily supports development funds for historic towns such as Blois, Chinon and Saumur and internationally famous castles such as Chambord and Chenonceaux. These efforts are reinforced by UNESCO (United Nations), which declared the Val de Loire a World Heritage Site in December 2000. Other projects are aimed to restore the environment of the Loire estuary between Nantes and its mouth at Saint-Nazaire, home to huge populations of freshwater and saltwater fish and migrating birds, which has been heavily polluted from harbor activities and large oil refineries on the north shore.

The Loire starts as a trickle from a small pipe on a volcanic peak (Gerbier-de-Jonc) in the Ardèche, 4,700 ft (1,425 m) above sea level, only a few meters from streams that find their way east into the RHÔNE, and to the Mediterranean. The swift mountain stream cuts deep gorges through the Massif Central, before passing the iron and coal centers of the 19th century at St.-Étienne ("the French Birmingham") and Roanne. From Roanne, the river opens up onto the plains of the north. Because the river is fed largely from mountain snows, it is liable to swift and disastrous floods in the spring.

Below the town of Nevers, the Loire is joined by its chief tributary, the Allier, and becomes the wide and voluptuously slow river that is famous among painters and poets for its reflective surfaces and rose mists. The river arcs gradually westward, passing the wine region of Sancerre and the first of the grand Renaissance chateaus, Sully-sur-Loire. Other large tributaries enter the river in its lower courses, the Maine from the north and the Vienne, Cher and Indre from the south. From here to the sea, the Loire is the major transport highway for wine, vinegar, grain, salt, timber, stone, coal, and iron, though it has always been hampered by slow currents and a shallow riverbed with frequent and shifting sandbars.

Islands in the lower Loire valley disappear and reappear overnight, causing serious dangers to transport craft. Boats take grain—the region produces 50 percent of France's total—either downriver, or to canals connecting the Loire to the Saône-Rhône and Seine river valleys.

Although the river passes several large and historically potent cities—for example, Orléans, where Joan of Arc first defeated the English in 1429—the country-

side is mostly rural, with numerous small villages. One in three “Ligerians” live in the countryside. The Loire Valley ends at Nantes, before opening up as the Loire estuary, with 35 mi (56 km) of rich wetlands. Nantes was traditionally France’s gateway to the world’s oceans (before being superseded by the deeper, more predictable waters of the Seine at Le Havre), and many French residents of North America trace their ancestry to emigrants from its ports.

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## London

LOCATED ON THE Thames River in southwestern England in the British Isles, London is the capital of England and the UNITED KINGDOM. The history of London can be traced back nearly 2,000 years to its founding as Londinium in 50 C.E. by the Romans. Much debate has occurred as to the exact type of Roman settlement that originated at the site, civilian or military. Archaeological evidence points to the original settlement starting as a civilian effort. For the next 400 years, the Romans controlled the strategic site on the edge of the Thames but eventually abandoned it.

Later, the Saxons established Lundenwic to the west of what would become the walled City of London in the 7th century. The walled City of London came into prominence during the Norman control of the area beginning in the 10th century C.E. It was at this time that present-day London began to take shape. Norman control of London continued for nearly 700 years, during which time a significant landmark, the Tower of London, was constructed. Stuart control of the city and the whole of England saw London’s importance continue to grow despite some major disasters such as the Great London Fire of 1666 and the previous year’s plague, which wiped out a large portion of the city’s population.

The 19th century saw London obtain the major global city status that it still enjoys today. The popula-

tion of the city rose from 1 million at the turn of the 19th century to over 6 million at the turn of the next. The city was the largest city in the world during this period, the capital of the BRITISH EMPIRE, and the global leader in politics, finance, and business. This period in London’s history is also marked by extreme social polarization with millions of the city’s inhabitants living in extreme poverty and appalling slums in the inner-city areas. Numerous landmarks were constructed during this century, including Big Ben, the Houses of Parliament, Trafalgar Square, and the Tower Bridge.

One of the biggest changes to London occurred in the 19th century: the introduction of the railroad, with the first line being opened in 1836 connecting Greenwich and London Bridge. Soon after, a large number of rail stations were constructed linking the city to the rest of the British HINTERLAND. In 1850, the London Underground was opened and soon the outflux of those who could afford to move to the open spaces of the periphery of London left the inner city residents to combat extreme poverty and disease.

### POPULATION PEAK

The population of London peaked in the 1930s around 8.6 million. The city was heavily damaged by German bombings during World War II. Over 35,000 Londoners were killed during the Blitz and over 10,000 buildings in the city were destroyed. The city was rebuilt after the war and continued to expand, consuming the surrounding landscape. The city added to its reputation as one of the world leaders in finance and banking by becoming a center of Western cultural and fashion change in the 1960s, led by such musical artists as the Rolling Stones and the Beatles. This cultural leadership continued into the 1970s and 1980s as the city was the epicenter for the punk and new wave movements.

While the population of the city itself dropped to around 7.2 million, the larger London metropolitan area has a population estimated at nearly 14 million, making it the largest metro area in Europe. London’s diverse ethnic makeup is the result of the city’s role as the capital of the former British Empire that spanned the globe.

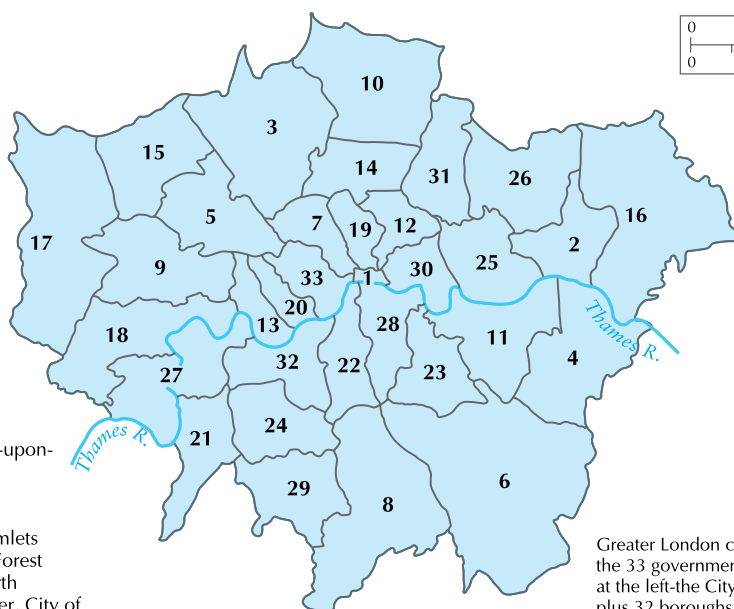
Seventy-one percent of the population consider themselves white, 10 percent Indian, Bangladeshi, or Pakistani, 5 percent black African and 5 percent black Caribbean. Over 300 languages are spoken, and the 2001 census shows that 29 percent of London’s population belonged to a minority ethnic group.

London is a leading world city when it comes to banking, finance, and insurance and one of the leaders



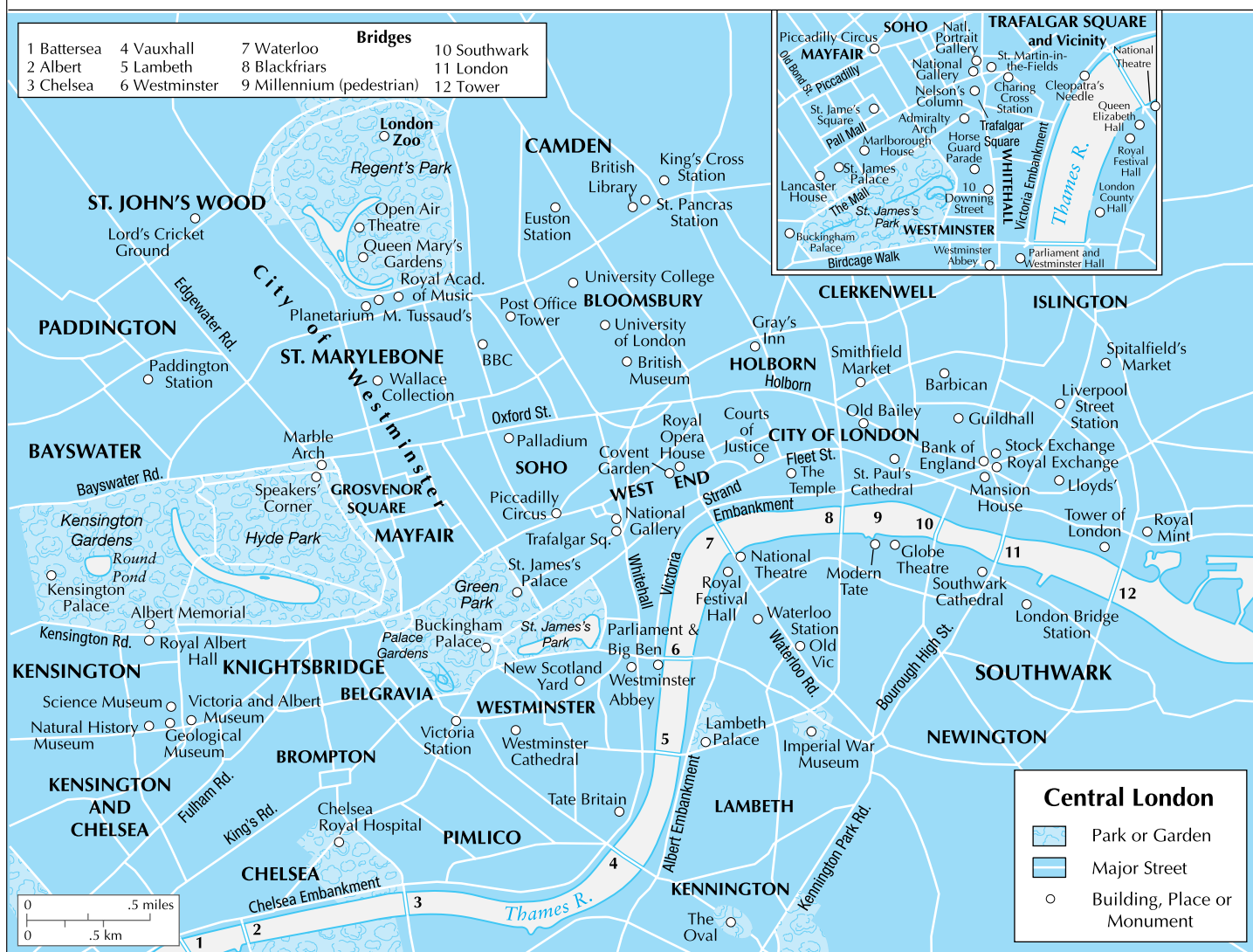
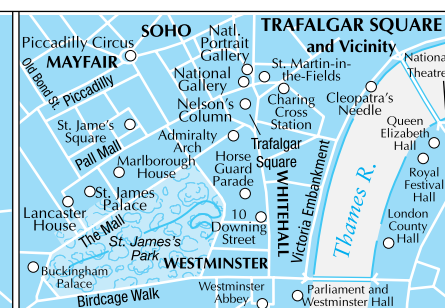
# Greater London

- 1 City of London
- 2 Barking
- 3 Barnet
- 4 Bexley
- 5 Brent
- 6 Bromley
- 7 Camden
- 8 Croydon
- 9 Ealing
- 10 Enfield
- 11 Greenwich
- 12 Hackney
- 13 Hammersmith
- 14 Haringey
- 15 Harrow
- 16 Havering
- 17 Hillingdon
- 18 Hounslow
- 19 Islington
- 20 Kensington and Chelsea,  
Royal Borough of
- 21 Kingston-upon-Thames, Royal Borough of
- 22 Lambeth
- 23 Lewisham
- 24 Merton
- 25 Newham
- 26 Redbridge
- 27 Richmond-upon-Thames
- 28 Southwark
- 29 Sutton
- 30 Tower Hamlets
- 31 Waltham Forest
- 32 Wandsworth
- 33 Westminster, City of



Greater London consists of the 33 government units listed at the left-the City of London plus 32 boroughs formed in 1965

1 Battersea	4 Vauxhall	7 Waterloo	10 Southwark
2 Albert	5 Lambeth	8 Blackfriars	11 London
3 Chelsea	6 Westminster	9 Millennium (pedestrian)	12 Tower





*The history of the global city of London can be traced back nearly 2,000 years to its founding as Londinium.*

in business. The city is host to 463 foreign banks, 56 percent of the global foreign equity market, and 429 foreign companies listed on the London Stock Exchange. Seventy-five percent of Fortune 500 companies have London offices. The city is the world's leading market for international insurance, with the worldwide premium income reaching over £150 billion in 2001.

Transport plays a vital role in the success of London not only internationally (almost £1 billion in overseas earnings are generated by the maritime industry) but locally as well. Heathrow International Airport is the one of the world's busiest airports serving over 63 million passengers, 90 airlines, and approximately 170

destinations. No fewer than four other international airports also serve the metropolitan area. The London Underground, the world's first underground rail network, provides transportation for a large number of Londoners. The system serves over 3 million daily, and nearly 1 billion annually, on its 253 mi (408 km) of track. Congestion on the city's streets and motorways has become so notorious that in 2003 London implemented a £5 per day fee for driving private automobiles in the central area during weekdays, as a way to reduce traffic congestion.

The city is home to five major symphonies, over a dozen major theaters, and numerous art galleries including the National Galleries and the Tate Galleries. A large number of world-famous museums have their homes in London, including the British Museum, the Science Museum, and the Victoria and Albert Museum. Churches and cathedrals are also part of London's cultural heritage, including Westminster Abbey and St. Paul's Cathedral.

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## Lop Nor

ALSO SPELLED Lob-Nor, Lop Nur, and Lop Nuur, this name invites confusion as it has been applied to a lake (actually two), a village, and a region in eastern XINJIANG province (CHINA). Lop is also the name of a "great desert" and a "large town" that Marco Polo mentioned and Faxian described. The city of Lop was well located at the center of a network of commercial roads leading to China proper, Tibet, and Turkestan. Caravans used to rest for one week in Lop before they undertook a one-month-long crossing of the desert. The SILK ROAD merchants sought to avoid the shorter but hazardous route through Lop. Only the bones of those who died during sandstorms helped travelers orient themselves though the immense plains of the Lop desert.

Some 217 mi (350 km) away from the Lop Nor Lake, Chinese maps show a city named Lop Nur (or Yuli) on the Konqi River that feeds the lake. "Lop"



designates also a village in Kara Buran, the southern basin of Lop Nor Lake. Curiously, the Mongolian-sounding name “Lop Nor” is not in use among the Loplaks, the Turkish people who inhabit the region. They employ the term *Lop* for the area that stretches from the Ughen Daria River to the city of Charkhlik. The Russian geographer Prschevalskij would have applied the name of the region to the lake (then desiccated) by mistake. Transcribed Luobu bo in Chinese, Lop Nor Lake used to be one of the terminal lakes of the Tarim River.

The Swedish explorer Sven Hedin called Lop Nor a “wandering lake” because the fluctuations of the Tarim have created two terminal lakes that are alternatively full and empty. When the river flows east, the Lop Nor fills up; when the river flows south, another terminal lake, the Kara Koshun, receives its waters while the Lop Nor dwindles. Dam and irrigation projects have severely altered the water supply of the Tarim-Konqi system to the entire lake area during the 20th century. Between 1921 and 1952, Lop Nor Lake covered 926 square mi (2,400 square km). The lake has been totally dry since 1964. All the other terminal lakes disappeared after 1972, when the construction of a large reservoir near Tikanlik, China, was completed.

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## Los Angeles

LOS ANGELES, CALIFORNIA, is the second most populous city in the UNITED STATES with an estimated 2002 population of approximately 3.8 million. Los Angeles (also known as L.A.) is the principal city of a metropolitan region with a population of over 12 million.

Located in the Los Angeles basin, the city is 470 square mi (1,215 square km). The extreme north-south distance is 44 mi (71 km), the extreme east-west dis-



*Los Angeles, America's western cultural geographic capital, is mostly at sea level elevation or a few feet above.*

tance is 29 mi (46.5 km), and the length of the city boundary is 342 mi (550 km).

The San Gabriel, Santa Monica, and Santa Ana Mountains surround the basin. The city is bordered to the west and southwest by the PACIFIC OCEAN. Earthquakes are probably the most prevalent natural hazard that the residents of Los Angeles face. It is estimated that there are nearly 30 magnitude 2.0 and higher earthquakes in southern CALIFORNIA everyday. The last significant earthquake to strike the Los Angeles area was the 1994 Northridge quake, measuring 6.7 on the Richter scale. It claimed 61 lives and caused over \$20 billion in property damage.

The city's name is attributed to the Spanish California's military governor, Felipe de Neve, who founded a new settlement and named it El Pueblo de la Reyna de los Angeles (the Town of the Queen of the Angels). The name was eventually shortened to Los Angeles. Founded in 1781, Los Angeles was an outpost under a succession of Spanish, Mexican, and American rule. The city became incorporated in 1850 and got a boost following its linkage by rail with San Francisco in 1876. The city was selected as the southern California rail terminus because its natural harbor seemed to offer little challenge to San Francisco, home of the railroad barons. After the introduction of the rail link, the city began to steadily grow in population.

The Mediterranean climate and vast open spaces mixed with agricultural and oil production, the creation of a deep water port, and the completion of the city-financed Owens Valley Aqueduct to provide addi-

tional water, all contributed to Los Angeles's continued growth.

The population swelled to 1.5 million by 1940. Following World War II, Los Angeles became the focus of a new wave of migration, with its population reaching 2.4 million by 1960. The population topped 3 million during the 1980s. After the 2000 census, the foreign-born population was 1.5 million, which was 41 percent of the city's total population. Racially, the city is a melting pot, in the 2000 census, 47 percent of the population identified themselves as white, 11 percent black, and 10 percent Asian. The white population percentage numbers include all those individuals who identified themselves as Hispanic or Latino. One in three residents in the metropolitan area was born outside the UNITED STATES.

### ECONOMIC DIVERSITY

Los Angeles's growth continues, anchored by its economic diversity. Services, wholesale and retail trade, manufacturing, government, financial service industries, transportation, utilities, and construction contribute significantly to local employment. Los Angeles County is the top-ranked county in manufacturing in the United States, producing more than 10 percent of the nation's production of numerous items ranging from aircraft, aircraft equipment guided missiles, and space vehicles, to television shows, movies, games, toys, and clothing.

### L.A. GATEWAY

The Los Angeles area is also a transportation gateway into the United States for both passengers and cargo. Fueled by trade with the Pacific Rim countries, the ports of Los Angeles and Long Beach combined rank first in the nation in volume. Los Angeles International Airport is served by 68 different passenger carriers and serves over 30 million passengers annually. The airport is the fifth-busiest cargo airport in the world, handling more than 1.96 million tons of origination and destination air cargo in 2002. The private automobile plays an important part of the Los Angeles lifestyle. Los Angeles County has 527 mi (848 km) of freeway and 382 mi (614 km) of conventional highway. Altogether, there are over 21,000 mi (33,796 km) of public roads in the county. On an average day, 92 million vehicle miles are driven in Los Angeles County.

As home to the film, television, and recording industries, as well as important cultural facilities, Los Angeles serves as a principal global cultural center. The area boasts 83 radio stations. Twenty of the stations

are in Spanish and nine others are in languages other than English including, Chinese, Korean, and Iranian. Twenty-six daily and 86 monthly/weekly newspapers are published within Los Angeles. Among them is the only Danish weekly newspaper published in the United States and a large array of papers published in other foreign languages.

The Los Angeles area is home to 29 television stations. Included among these stations is KSCI Channel 18, which is Los Angeles County's most linguistically diverse television station and the leading Asian language television station in the United States. It provides programming and entertainment in 14 languages, including Arabic, Armenian, Khmer, Cantonese-Chinese, English, Farsi, Hindi, Hebrew, Japanese, Korean, Mandarin-Chinese, Tagalog, Urdu, and Vietnamese. Los Angeles, like its sister city NEW YORK, is a multicultural metropolis.

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## Louisiana

SITUATED AT THE MOUTH of the MISSISSIPPI RIVER on the coast of the Gulf of Mexico, Louisiana and its people have long been influenced by the intersection of these two major water features. The physical geography of Louisiana can be examined in terms of its five natural regions: the Coastal Marsh; the Mississippi Flood Plain; the Red River Valley; the Terraces; and the Hills. Each has played an important role in the history of the state. The southernmost of these regions is the Coastal Marsh, which serves as a transitional area between land and sea. Characterized by fresh and salt-marsh vegetation as well as peat soils, this natural region serves to provide rich fishing grounds that support the second-largest seafood industry in the UNITED STATES today.

Heading northward away from the coastal areas, rivers dominate not only the physical landscape but also the economic geography of Louisiana. The Red and Mississippi rivers are distinguished as separate natural regions because of soil and drainage differences,



however, they are inherently interconnected and provide an extensive waterway transportation system upon which the Louisiana economy has been built. Combined with five deepwater ports and proximity of the Gulf of Mexico, the river system of Louisiana serves as natural gateway for the exchange of not only goods produced in the state but much of the U.S. mid-west as well. While the petrochemical and mineral resource industries are most often associated with the importance of waterway transportation today, the fertile flood plains of the Mississippi River have long been a source of agricultural wealth for the state by producing large quantities of cotton, soybeans, and rice. Rising above the river floodplains into the Terraces and Hills, the forest industry prevails because of the availability over 13 million acres (5.2 million hectares) of hardwood and pine forests.

Natural resources alone do not provide all of the state's economic foundations. Louisiana has also developed a strong tourism industry premised upon its unique cultural heritage. The idea of "cultural gumbo" is often used to describe the people of Louisiana, as they are like the famous gumbo dish created out of many separate ingredients that blend together to create a delightful experience. Throughout its history, the territory that now encompasses Louisiana has been governed under 10 different flags. Although originally claimed by Hernando de Soto for SPAIN in the early 1540s, Louisiana remained largely ignored by Europeans until Robert de La Salle claimed the territory for FRANCE in 1682. The first permanent settlement was finally established in 1714.

Despite the strong French and Spanish presence in the territory, other Europeans, including Germans farmers, began to arrive, each adding their own influences to the Louisiana culture and landscape. With a military victory over France and Spain in 1763, Great Britain also laid claim to the portion of Louisiana east of the Mississippi River basin. While European nations struggled with each other for control of Louisiana, other cultural groups continued to arrive. The rich soils of the river lands fostered the growth of a plantation economy that depended upon the importation of African and Afro-Caribbean slaves who contributed to the formation of the culture in south Louisiana. This area was also settled by Creoles, the French-speaking Acadians who fled British control of Nova Scotia and made their way into south-central Louisiana and are today recognized by the name Cajuns.

Even after the LOUISIANA PURCHASE in 1803 and its incorporation into the United States in 1812, portions

of Louisiana would be governed under a foreign flag. In 1810, a controversy arose between the United States and Spain over the control of portions of eastern Louisiana, resulting in the declaration of the short-lived independent Republic of West Florida. Finally, in 1861, Louisiana seceded from the Union and after only a six-week period as an independent republic joined the Confederacy and its efforts in the Civil War. After the conclusion of the war, Louisiana was readmitted to the Union in 1868.

Despite the passage of over 130 years of continual U.S. control, the people of Louisiana have seldom forgotten their past and continue to draw upon it today to create a diverse cultural experience blended from a unique history and environment.

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## Louisiana Purchase

THE LOUISIANA PURCHASE (1803) included all of the present-day states of ARKANSAS, OKLAHOMA, MISSOURI, KANSAS, IOWA, and NEBRASKA, as well as parts of MINNESOTA, SOUTH DAKOTA, NORTH DAKOTA, MONTANA, WYOMING, COLORADO, NEW MEXICO, TEXAS, and, of course, LOUISIANA. The area is approximately one-third of the continental UNITED STATES. Initially, it included portions of CANADA—southern Manitoba, southern Saskatchewan, and southern Alberta—that drain into the Missouri River.

On April 30, 1803, for 60 million francs (approximately \$15 million) under a treaty with FRANCE, the United States received the Louisiana Territory, land in excess of 800,000 square mi (2 million square km). The purchase incorporated territory from the MISSISSIPPI RIVER to the ROCKY MOUNTAINS. The treaty specified that France would receive \$11,250,000 in cash, and for the remainder of the price, the United States would

assume French debts to American citizens. The territory had belonged to France until the end of the French and Indian War. In 1762, France ceded it to SPAIN. Spain gave it back in 1800 under the secret Treaty of San Ildefonso. The French ruler, Napoleon Bonaparte, wanted to re-establish French presence in the Americas, and the Mississippi Valley was to serve as the center of trade and food production for Hispaniola, the Caribbean heart of the new empire. Haitian slaves led by Toussaint L'Ouverture upset this dream in 1801 when they rose against their masters and seized control of the country. Napoleon's efforts to suppress the rebellion failed, in part because of yellow fever among the French troops, and Napoleon abandoned his dream of a western empire. Napoleon needed his troops for his anticipated war with Great Britain. He also needed money for his European adventures, so he decided to sell Louisiana.

The U.S. president, Thomas Jefferson, had negotiators in Paris, trying to get a tract on the lower Mississippi or the right of free navigation through New Orleans. American vulnerability in New Orleans had become apparent in October 1802 when the Spanish intendant at New Orleans closed the port by suspending American right of deposit, prohibiting Americans from storing their cargoes in the city. Westerners were concerned, to put it mildly, and the giving of Louisiana to France did not calm them at all.

Jefferson responded by instructing his minister in Paris to buy land on the lower Mississippi to serve as an alternative port. James Monroe went over in early 1803 as minister plenipotentiary to assist in the negotiation. Monroe had authority to offer \$10 million for New Orleans and West Florida. Napoleon had already decided to sell before Monroe arrived. When Napoleon offered all of Louisiana, the American negotiators quickly arranged the deal. The purchase more than doubled the size of the United States, provided land for settlement, and guaranteed free navigation on the Mississippi. Jefferson had concerns that the U.S. Constitution didn't authorize the acquisition of new territory by treaty, but he decided that the good to the nation outweighed his philosophical concerns about violating the Constitution. The Senate ratified the treaty on October 20, 1803. On November 30, the Spanish, who had remained in occupancy during the French ownership, yielded Louisiana to France, which in turn ceded it to the United States on December 20.

Louisiana, in 1803, had a population of about 50,000. Ten thousand lived in New Orleans. Over half of the population, 28,000 people, were slaves. The

count included residents of British West Florida (given to Spain after the American Revolution) and transplanted Acadians by way of NEW YORK and St. Domingue.

Spanish immigrants from the CANARY ISLANDS reflected the attraction of Spain's liberal land policies in Louisiana. Approximately 10,000 settlers—master and slave—fled the slave revolt in St. Domingue. And some French left France because of the nature of Napoleon's regime. At the same time, Spanish officials and settlers left for Spain. There were free blacks in New Orleans and Natchitoches. Anglo immigration into the area had begun over a decade before the purchase. Spain disapproved of the sale, but Congressional approval forestalled any action. Jefferson appointed a territorial governor, William Charles Cole Claiborne, and sent him along with General James Wilkinson to take possession, which they did on the December date. A formal ceremony on March 10, 1804, completed the transfer from France to the United States.

Not everyone applauded the deal. The Federalists, who wanted the United States to support Britain instead of France, claimed that the purchase was unconstitutional. In their view, the United States had spent a lot of money simply to declare war on Spain. Furthermore, the new land had the potential to shift the balance of political power away from the Atlantic coast to the west. Eastern bankers merchants and western farmers often had clashing interests anyway. Timothy Pickering, senator from Massachusetts, led a Federalist cabal that sought to separate New England into a separate confederacy, with Vice President Aaron Burr as president. Alexander Hamilton intervened, prevented secession, and eventually died at the hand of Burr in an 1804 duel.

## LEWIS AND CLARK

Jefferson wasted no time in finding out what he had bought. From the time that Jefferson was secretary of state, he had been interested in the Spanish territory blocking the United States from the Pacific. Even before the finalization of the purchase, when Spain refused his request to explore the territory, he had authorized an expedition by his secretary, Meriwether Lewis, to study the land and find a river route to the PACIFIC OCEAN.

His January 18, 1803, secret request to Congress cited the need to subdue natives and counter infiltration by the French. The next month a "commercial venture" was okayed at a price of \$2,500. Lewis began buying supplies and learning scientific observation.



*The Louisiana Purchase from France doubled the size of the United States, greatly strengthened the country in resources and territory, and provided a powerful impetus to westward expansion, especially after the Lewis and Clark expedition.*

When Napoleon was selling Louisiana to the United States, Lewis was in Pittsburgh, Pennsylvania, buying instruments, guns and ammunition, medicine, trade goods, and a keelboat. In May, with William Clark, Lewis began the three-year exploration of the Louisiana Purchase northern area. When they returned in 1806, they had amassed invaluable information about the plains, the mountains, and the rivers that would later be crossed by the Oregon Trail. They also brought information about the various Indian groups they encountered en route to the Pacific, and they gave the United States a claim to OREGON that was much firmer than that of Captain Robert Gray, who had been in Puget Sound as early as 1789.

Although Lewis and Clark could not find the river route Jefferson wanted, they did end the hope for a northwest passage to CHINA. They reported the pres-

ence of obstacles such as the Great Falls of the Missouri and the Dalles on the Columbia that required exhausting portages. With peaks rising 2 mi (3.2 km) into the air, the ROCKY MOUNTAINS themselves were intimidating. Lewis and Clark established that wagon traffic could not exploit their route.

A large part of the purchase was a “wasteland.” Between the line of settlement in western Missouri and the ROCKY MOUNTAINS, there was an area where average annual rainfall is less than 20 in (8 cm), insufficient for 19th-century American farmers. Jefferson was aware; he wanted the port of New Orleans, not the wasteland he felt upper Louisiana to be. He got affirmation from Lewis and Clark, whose journals frequently noted treeless and arid land whose rivers were trickles vanishing into the sand. In 1806, Zebulon Pike explored from the Missouri to the Rockies on the lati-

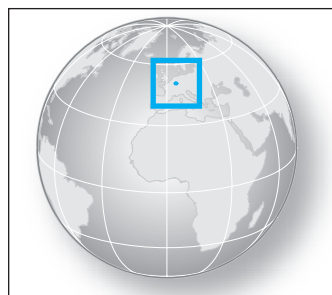
tude of Kansas, and he encountered sand dunes and land too arid for farming or timber. Stephen Long crossed at the latitude of Nebraska in 1819–20 and reported that the drainage basin of the Missouri and Arkansas rivers, as well as a great portion of western Kansas and Nebraska was a great American desert. Even as migrants crossed the land to the valuable areas in Oregon and California, the desert remained. Only in 1870 did the designation change. Immigrants to Kansas from RUSSIA brought dryland farming techniques that made the great desert into the Great Plains.

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## Luxembourg

**Map Page** 1131 **Area** 998 square mi (2,586 square km)  
**Population** 454,157 (2004)  
**Capital** Luxembourg **High-est Point** 1,834 ft (559 m)  
**Lowest Point** 436 ft (133 m)  
**GDP per capita** \$55,100  
**Primary Natural Resources** arable land.



LUXEMBOURG IS a small LANDLOCKED western European country, within the EUROPEAN UNION (EU), and given its small population size, the country does not contain any large urban centers. After Luxembourg City, about 75,000 persons, the next largest settlements are Esch-sur-Alzette (27,000), Differdange (18,000), and Dudelange (17,000). Split into three administrative regions (Diekirch, Grevenmacher, and Luxembourg), Luxembourg is governed by a constitutional monarchy. Bordered by GERMANY to the east (the border being formed by the Our, Sûre and Moselle rivers), FRANCE to the south, and BELGIUM to the west and

north, the country has been historically and culturally influenced by countries neighboring it. Linguistically at least, the neighboring influence persists. Legal and political matters, for instance, are still written in French, while police records are noted in German. Officially, three languages (Luxembourgish—a mix of Frankish and old German—French, and German) are spoken in Luxembourg.

In terms of physical geography, Luxembourg has a temperate climate that can be characterized by cool, sometimes cold winters and warm summers. The northern part of the country forms part of the Ardennes hill range and has an undulating topography. The highest point is some 1,834 ft (559 m) above sea level, although the other regions of the country may be described as being somewhat hilly as well. In terms of land use, about 25 percent of land is cultivated, a further 20 percent is used for pasture, and 20 percent is wooded. Given its small spatial extent, Luxembourg has a relatively high population density, even though its urban places are not large demographically.

### MODERN ECONOMICS

In economic terms, Luxembourg may be characterized as a low-unemployment, low-inflation, and high-income society. Industry, particularly steel, has historically been significant in Luxembourg but has in recent times been surpassed by the growth of other industries, such as rubber and chemicals, as well as the rise of the tertiary economic sector, especially the banking sector which is largely based in Luxembourg City.

Located at the junction of the Alzette and Pétrusse rivers, Luxembourg City, the capital, is today a settlement of modern international banking repute and also the location of several European Union institutions. These include the European Court of Justice, the European Investment Bank, and the Secretariat of the European Parliament. Because of its exceptional location and the surrounding natural environment, Luxembourg City has historically been a place of military significance.

As an area noted in written history, Luxembourg dates from the 10th century when it was known as Lucilinburhuc (“little fortress”). At this time Siegfried, Count of Ardennes, erected a castle (now in Luxembourg City). From 1506 to 1890, Luxembourg formed part of the territories of numerous European countries, including SPAIN, France, AUSTRIA, and the NETHERLANDS, and it was not until 1815 that the process of independence in Luxembourg began, a consequence of the forming of a Grand Duchy by the Congress of Vienna. The



Congress, held in 1814 and 1815, redrew the continent's political map following the defeat of Napoleonic France, and one of the principle results of the event, aside from the confirmation of France's loss of territories it had annexed between 1795 and 1810, was that the Luxembourg Grand Duchy was formed and the Netherlands became an independent kingdom.

As part of this Europe-wide development, the Luxembourg Duchy was handed to the Dutch monarch, William I. In 1838, political autonomy was granted to by the Netherlands, yet it was not until 1890 that Luxembourg became independent as such from the Dutch, a result of the death of William III. Upon his death William was succeeded by his daughter, but as only men could inherit the title of Grand Duke, it passed to another blood line of the Dutch royal house. The throne thus was offered to William's cousin, Duke Adolf of Nassau, who subsequently became Grand Duke Adolf I of Luxembourg. Today Luxembourg remains the world's only grand duchy.

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## Luxor

LUXOR IS LOCATED on the banks of the middle reaches of the NILE RIVER, in Qena governorate, east-central EGYPT. Approximately, 440 mi (700 km) south of Cairo, it is a bustling city with a population of about 150,000. As a modern city, it caters to tourists who are attracted to the famous archaeological sites that attest to Egypt's rich history. These are present in the nearby Valley of the Kings and in Denderah and Abydos just to the north, as well as in Luxor itself. The city comprises three areas: the City of Luxor on the east bank of the Nile, Thebes (also known by the ancients as Waset) on the opposite bank, and Karnak to the north.

Luxor was the capital of Middle Egypt for 1500 years. It became prominent in the 21st century B.C.E.; as Thebes it maintained its status as capital until 661 B.C.E. when it was attacked by the Assyrians. Its significance in the ancient world is recorded by Homer, the famous Greek poet who lived in the 8th century B.C.E.,

as "the city of a hundred gates." It survived as an influential center until it was destroyed by the Romans in 30 B.C.E. Although it never fully recovered, Luxor has been a place of interest, almost of pilgrimage, for centuries and it ranks as one of the first true tourist destinations.

There is some evidence for settlement in the Luxor area relating to the Old Kingdom of ancient Egypt which had its focus in Upper Egypt, notably in the Nile delta region where the Great Pyramids were constructed and where the capital, Memphis, was located. This period dates from 2686 B.C.E. to 2181 B.C.E. and is represented at Luxor by ancient tombs; one such necropolis is el-Khoka. There may also have been a temple in Karnak, and it seems likely that Luxor (then Waset) was a provincial town.

The Old Kingdom was followed by an Intermediate period from 2180 B.C.E. to 2040 B.C.E., and then the Middle Kingdom from 2040 B.C.E. to 1730 B.C.E. During the Intermediate period, Luxor began to grow in size and significance under the direction of the 7th to 9th dynasties of rulers and achieved capital status during the reign of Mentuhotep of the 11th dynasty, who once again unified Egypt into one kingdom. He also constructed the temple at Deir el-Bahri on the west bank where his mortuary temple is also located. Luxor (then Thebes) benefited from trade. Its location, on the fertile bank of the Nile adjacent to Nubia and the eastern desert, was advantageous for the acquisition and control of resources being traded north to south and east to west. There was a decline in its political status during the 12th dynasty, as the ruler Amenemhat 1 conferred capital status on El-Lisht close to Memphis, but Luxor's religious influence escalated as the local god, Amun, became a principal deity throughout the kingdom. The remains of a temple to Amun, dating from this period, are present at Karnak.

The advent of the New Kingdom, dating from 1552 B.C.E. to 1069 B.C.E., saw Luxor achieve renown as a religious center. It had become a center of life and death. Active worship in its many temples was juxtaposed with the numerous and rich tombs and mortuary temples excavated in the cliffs of the west bank. Included in the latter are the mortuary temples of Rameses II and Seti I as well as the remains of the temple of Amenhotep III. Further west into the desert, so as not to use fertile land, lie the tombs of the Valley of the Kings that have helped to make Egypt so famous. Not least of these is the tomb of the boy king, Tutankhamen of the 18th dynasty, who ruled Egypt from 1361 B.C.E. to 1352 B.C.E. This was discovered in 1922 by Lord

George Carnarvon and fueled much renewed interest in Egypt and its history. On the east bank, Luxor and Karnak became the location of major temple complexes whose architecture and inscriptions are testament to the stonemasonry and building technology of the Middle and New Kingdoms. The majesty of the temples is encapsulated in the 134 huge columns of Karnak temple's Hypostyle Hall. The temple of Luxor was built by Amenophis III.

Luxor retained some importance during the Late Period from 664 B.C.E. to 30 B.C.E., but its golden age was over. Much later, Christian churches, Islamic mosques, and a tourist infrastructure added to the heterogeneity of one of the world's oldest cities.

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## Luzon

THE ISLAND OF LUZON is the largest and most populous island in the PHILIPPINE archipelago (17th largest in the world), the center of Philippine political and economic life, and the site of the capital city, MANILA. With roughly 42 million people occupying a total land area of 40,420 square mi (104,688 square km)—roughly the size of VIRGINIA, with nearly 10 times the population—Luzon has one of the highest population densities in the world, in large part because of the fertility of its volcanic soil and abundant rainfall.

Luzon is also one of the most Europeanized areas in Asia, thanks to its convenient location at the western terminus of the Pacific TRADE ROUTES used continuously by the Spanish from the early 16th century. Spanish language and religion dominated the island for the next three centuries, until the islands came under the influence of the UNITED STATES at the end of the 19th century. Luzon is divided into seven regions, each with numerous provinces (30 total on Luzon), and three cities with over 1 million people: Quezon City (2.17 million), Manila (1.6 million), and Caloocan City (1.2 million).

The island is the northernmost in the Philippine group, with the exception of the smaller Batan and Babuyan islands in the Luzon Strait. This strait separates the Philippines from TAIWAN by about 220 mi (370 km). To the east lies the Philippine Sea (part of the PACIFIC OCEAN, bounded by the northern MARIANA ISLANDS, GUAM, Yap, and PALAU), and the South China Sea lies to the west.

The southern coasts of the island border the complex Sibuyan Sea lying between the nearby islands of Mindoro, Masbate, Samar, and Visayan. Formed about 50 million years ago from a combination of volcanoes and the buckling of the Earth's crust, Luzon lies along one of the most active edges of the RING OF FIRE, which extends northward from Sulawesi, INDONESIA, to JAPAN.

The Philippine Trench lies just off the east coast of Luzon, marking the convergence zone of the Philippine and Asian tectonic plates. The trench runs parallel to the island its entire length, plunging to depths of 33,000 ft (10,000 m). A number of Luzon's mountains are volcanoes, including its most active, Mayon (7,943 ft or 2,407 m), which last erupted in January 2004 and rivals Mount Fuji, Japan, in perfection of its symmetry. Mount Pinatubo (4,874 ft or 1,477 m), northwest of Manila, erupted in June 1991 and devastated an area of 154 square mi (400 square km), blanketing much of Southeast Asia with ash. Modern prediction techniques, however, prevented a potentially massive loss of life, and the death toll reached only 250.

The island is a construction of these volcanic chains and owes its erratic shape to this; it is essentially two landmasses: the larger northern portion and the narrower extension to the southeast, the Bicol Peninsula, connected to the rest of Luzon by the Tayabas Isthmus, which is only 8 mi (13 km) wide at points. The Zambales mountain range forms the westernmost part of the island.

Two mountain chains dominate the northern part of the island, the Cordillera Central—including the highest peak, Mount Pulog (9,682 ft or 2,934 m)—and the Sierra Madre along the northeast coast. In these mountains are some of the most inaccessible human populations on Earth, including the Bontoc and other mountain peoples. Another mountain chain forms the Bicol Peninsula. The longest river on Luzon flows between the Cordillera and the Sierra Madre, the Cagayan, which is navigable for a considerable distance and has potential for hydroelectrical power. The most important river for traffic and commerce is, however, the much shorter Pasig, which flows through Manila,

and links Leguna de Bay (the country's largest lake) with Manila Bay.

Luzon has mineral wealth, including two of the principal gold mines in the Philippines, in Mountain Province and Camarines Norte. Other resources include copper, asbestos and chrome. But the island is primarily an agricultural producer, mostly of rice, but also corn, tobacco, sugar, cotton, and several tropical products (coconut, mango, banana, cacao, etc). Nearly all industries are concentrated in Greater Manila. The people are related ethnically and linguistically to Malays; Tagalog, the dialect spoken in the region around Manila, became the official national language (called Filipino).

From conquest by SPAIN in the 1520s, the island was developed by large plantations (mostly in the north of the island, where there is the flattest land); using mostly forced labor, the Spanish produced tobacco at first, followed by sugar, coffee, indigo, and pepper—to compete with exports from the Dutch East India Company. Missionaries naturally followed, and the island was 80 percent Catholic by the time of the

U.S. occupation in 1898. The island retains much of its Spanish culture, despite the growing influence of British and American traders from earlier in the century. Status as a U.S. protectorate was generally beneficial to the island in many respects, for example in literacy, which was five times the rate of neighboring INDONESIA by the 1940s. The U.S. naval base at Subic Bay and Clark Air Base provided numerous jobs and economic activity. Hopes for transforming this area into a free trade zone since the bases' closure in 1992 have so far failed to materialize. Christian Luzon also faces increasingly hostile separatist movements from the Muslim-dominated southern islands.

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## Macau

MACAU IS LOCATED in the southern part of CHINA's Guangdong Province, near the tip of the peninsula formed by Pearl River on the east and Xinjiang River on the west. Macau is situated 37 mi (60 km) west of HONG KONG and comprises the Macau Peninsula and the islands of Taipa and Coloane.

Macau has mostly flat terrain resulting from land reclamation done over an extended stretch. However, Macau does have some steep hills as well. The climate of Macau is subtropical and is hot and humid for most of the year. The average year-round temperature is about 77 degrees F (25 degrees C); June to September is the hottest period, with temperatures exceeding 86 degrees F (30 degree C). Macau receives an average of 80 in (203 cm) of rainfall annually; typhoons hit Macau and adjoining areas with a high degree of frequency during the monsoon season.

Macau was colonized by the Portuguese in the 16th century and was the first European settlement in East Asia. China and PORTUGAL signed an agreement on April 13, 1987, which made Macau a Special Administrative Region (SAR) of China, effective December 1999. In modern times, Macau has developed industries such as textiles, electricity, as well as a first-rate tourist industry with a wide assortment of hotels, resorts, and sports facilities. Macau's economy is closely



linked to HONG KONG and Guangdong Province in the Delta region. Macau provides banking training, communication and transport facilities in Far East and Northeast Asia.

Chinese and Portuguese are the official languages in Macau. Cantonese, however, is most widely spoken. The official languages are used as link languages in government departments and in all official documents and communication sectors inside Macau. English is generally understood and is used in trade, tourism, and commerce. In terms of ethnic groups, Macau's population comprises Han Chinese at 95 percent; Portuguese, 3 percent; and other, 2 percent. Of those, 44 percent are born in Macau, 47 percent in China, and 9 percent elsewhere. Although the term *Macanese* is used to describe the citizens of Macau, the term also applies to biracial Chinese-Portuguese individuals, persons of exclusive Portuguese descent, and Chinese or mixed Chinese-Portuguese individuals who have been baptized and taken Portuguese names.

Macau has a high percentage of literacy: 90 percent of the population age 15 and above can read. Among males, 93 percent have achieved basic literacy, and among females, 86 percent are literate. Buddhism remains the most dominant religion in Macau, with over 45 percent of Macau's population subscribing to it. Roman Catholics represent 7 percent, Protestants 1 percent, and other religions (Hindu, Muslim, and

other) 1.2 percent, whereas 45.8 percent of population has no official religious preference.

Textile and garment manufacturing are major industries in Macau accounting for 83.8 percent of principal domestic exports. Other major sectors are electricity, footwear and toys. Macau's industries have benefited a great deal from its close geographical proximity with China, which provides Macau basic raw materials. China, Hong Kong, and the EUROPEAN UNION rank among the top three countries in terms of Macau's principal import trade partners.

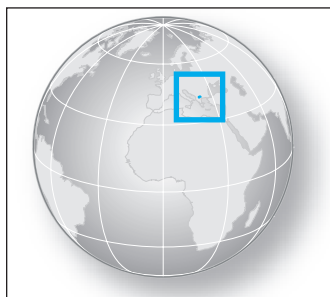
In the latter half of the 20th century, Macau's economy flourished with increased tourism. The tourism-related service sector has provided an estimated 30 percent of labor force and has contributed approximately 50 percent gross national product to Macau's economy.

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## Macedonia (FYROM)

**Map Page** 1133 **Area** 9,781 square mi (25,333 square km) **Population** 2,063,122 **Capital** Skopje **Highest Point** 9,085 ft (2,753 m) **Lowest Point** 165 ft (50 m) **GDP per capita** \$5,000 **Primary Natural Resources** chromium, lead, zinc, manganese.



THE REPUBLIC OF Macedonia is a country in the southern Balkans but covers only part of the larger historical and geographical area known as Macedonia. The northern region of GREECE is also known as Macedonia, which has been a source of cultural conflict since the republic declared its independence from Yugoslavia in 1991. Greeks assert that the name "Mace-

donia" is a specifically Greek term, and not applicable to the Slavic people who today make the region their home. Pending United Nations-moderated negotiations, Greece and most international bodies officially refer to the republic as FYROM, the Former Yugoslav Republic of Macedonia.

Macedonian nationalism, as distinct from other south Slavic peoples is, moreover, a relatively new concept, introduced and encouraged by dictator Josip Tito upon the creation of a separate Macedonian Republic within the Yugoslav Federation in 1946. Prior to this, the area generally known as Vardarska banovina (the district of the Vardar River) was considered simply an extension of its southern Slavic neighbors, either Serbians to the north, or Bulgarians to the east. Slavs arrived in the Balkan Peninsula only in the 6th century, and therefore have nothing to do with the well-known classical kingdom of Macedonia, which dominated the rest of Greece, the Near East, EGYPT, and Persia under Alexander the Great in the 4th century B.C.E. The region was controlled by the Ottoman Turks dating from the 14th century, then contested by Greece, BULGARIA and SERBIA after the First Balkan War of 1912, which immediately led to the Second Balkan War of 1913. The result of this war was a partition of Macedonia between these three powers, the southern half going to Greece, the northern half incorporated into the kingdom of Serbia, and a small eastern portion, called Pirin Macedonia, given to Bulgaria. The Yugoslav Republic of Macedonia was set up after World War II in part to offset the continued claims of Bulgaria on the Vardar valley.

The Vardar River dominates Macedonia, nearly bisecting the country, and providing its chief outlet to the sea. Because Macedonia is LANDLOCKED, its economy relies heavily on transport down the Vardar across northern Greece (where the river is called the Axiós) to the major Aegean port city of Thessaloniki. Greece's trade embargo against FYROM from 1994 to 1995 was thus of great significance. Similar international embargoes against Serbia during its wars of ethnic cleansing in the 1990s cut Macedonia off from its largest trading partner.

The economy was strained even further by the flood of more than 350,000 Albanian refugees in 1999, most of whom have today returned to Kosovo. Macedonia had its own ethnic conflict in 2001, when a group of Albanians began an insurgency in the western part of the country, demanding greater rights for the country's Albanian minority. Ethnic Albanians make up roughly 23 percent of the population, chiefly con-

centrated in the western part of the country, across the borders from the Republic of ALBANIA and the Serbian province of Kosovo.

Macedonia is almost entirely mountainous; 14 peaks exceed 6,600 ft (2,000 m). The highest are in the western part of the country, running roughly from northwest to southeast. The Šar mountains in the northwest, and the Crna Gora (Black Mountains) form the border with Serbia in the north, while the Osogovo Mountains run along the eastern border with Bulgaria. The southern border with Greece is defined by the Nidze mountains. Most settlements are in the larger river valleys, the Crna, Treska, Pcinja, and Bregalnica, all tributaries of the Vardar. Skopje, the country's capital (population about 500,000), is located on the Vardar River. Other major cities are Tetovo, Kumanovo, Gostivar, Bitola, Ohrid, and Titov Veles.

The climate in Macedonia is a mixture of Mediterranean, continental, and mountain. Crops are therefore varied depending on elevation. Agriculture is dominant but there are also significant industries, including chemicals, steel, and textiles. Macedonia was Yugoslavia's poorest republic, but political and cultural disturbances of the past decade have exacerbated its economic struggles—roughly 40 percent are unemployed—and the area is also prone to earthquakes and drought. Large numbers of NORTH ATLANTIC TREATY ORGANIZATION (NATO), United Nations, and EUROPEAN UNION (EU) troops are stationed in Macedonia (nearly 20,000 in 1999), mostly in relation to peacekeeping missions in neighboring Kosovo, which both stimulates the economy and causes further strain on it.

A change in the flag (dropping Alexander the Great's 16-point Vergina Sun for a simpler eight-point star) in 1995 and a change in the wording of the constitution have allayed Greek fears of south Slavic expansion and allowed for greater recognition in the diplomatic world and economic aid from the EU and the rest of the international community. Macedonia in 2004 was a candidate for membership in both NATO and the EU.

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## Mackenzie-Peace River

THE MACKENZIE-PEACE River system is made up of the Mackenzie and Peace rivers. Located in western CANADA, this is the 10th-longest river system in the world, at 2,635 mi (4,240 km). Sir Alexander Mackenzie, a Canadian explorer, discovered the river in 1789 and it was named for him. By itself, the Mackenzie River is the longest river in Canada, with a length of about 1,118 mi (1,800 km). At places it is 2 mi (3 km) wide. It starts in the Northwest Territories at Great Slave Lake and flows north into the Beaufort Sea of the ARCTIC OCEAN.

The Mackenzie-Peace River system drains .70 million square mi (1.8 million square km), about one-fifth of Canada, and includes Great Slave Lake, Great Bear Lake, and Athabaskan Lake. Small ships can travel about 1,700 mi (2,750 km) along the Mackenzie-Peace Waterway. The river is navigable from about June until October each year. The rest of the year it is frozen over.

The region where the river empties into the Beaufort Sea is known as the Mackenzie Delta. The area was once a large bay. Here land has built up from the sediment carried by the river and dropped as it slows down to enter the sea. The Mackenzie Delta is the largest delta in Canada and the twelfth largest in the world. Unlike most deltas, this one is confined by high landforms on both sides. The Richardson Mountains are to the west and the Caribou Hills are on the east. This keeps the delta from expanding in either direction. About 3,000 Inuvialuit live in the Delta communities of Aklavik, Inuvik, and Tuktoyaktuk. These Native Americans have made a comeback after being nearly obliterated by diseases in the early 1900s.

The most important tributaries are the Liard River, the Peel River, and the Bear River. Most of the land along the waterway is not settled. Much of it is heavily forested. The small communities that do exist along the water are connected only by the river. There are no roads in the area. The most northerly of the Athapaskan-speaking people live in the boreal forests of the Mackenzie Delta and rely, as they always have, on the caribou for food and clothing. Muskrat trapping has also long been a part of the delta economy. Muskrats are plentiful in the many lakes on the delta. Other mammals found on the Mackenzie Delta include black bears, grizzly bears, moose, red fox, Arctic fox, snowshoe hare, Arctic wolf, and musk ox. Beluga whales winter in the Bering Sea, but enter the waterways of the delta in the spring. Tundra swans breed on the tundra, then migrate as far south as central California. Beauti-



By itself, the Mackenzie River is the longest river in Canada with a length of about 1,118 mi (1,800 km).

ful wildflowers cover the tundra during the brief summer. About 100 species grow here, including purple crocus; white, pink, and purple Indian paintbrush; yellow cinquefoil; blue Arctic lupins; and red, yellow, and purple sweetpeas.

The delta contains deposits of minerals, gas, and oil. The Dene natives knew for a long time that there was oil along the lower Mackenzie River. They called the area “Le Gohini,” which means “where the oil is.” They finally showed the site to geologists in the early 1900s. The first oil well was drilled there by Imperial Oil in 1919, then a small refinery was built that supplied nearby communities with oil. In the 1940s, the U.S. Army helped with construction of a pipeline from the Norman Wells Oil Fields on the Mackenzie to Whitehorse, Yukon. They were afraid the Japanese would attack their west coast refineries.

However, the war ended just as the pipeline was completed. In the early 1980s, production there reached full capacity. Today Norman Wells averages 10 million barrels of oil per year, Canada’s fourth-largest oil-producing field.

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## Mackinder, Halford J. (1861–1947)

HALFORD JOHN MACKINDER was born on February 15, 1861, in Gainsborough, a small port and market town at the river Trent in England. He was the eldest of six children born to Dr. Draper and Mrs. Fanny Anne Mackinder. His father was well educated and trained as a scientist. It was he who taught Mackinder to look for “interrelationships between factors in the environment.” In 1870, he went to Gainsborough Grammar School and from 1874 he was educated at Epsom College. His father always wanted him to be a doctor, and Epsom had a sound reputation for its advanced training in the sciences. At school Mackinder showed strengths in essay writing, languages, public speeches, and environmental sciences. Furthermore, he developed an enthusiasm for historical geology. In 1880 he and his friend Thomas Walker won a five-year Junior Studentship in physical sciences and in October of the same year the two men went up to Oxford and entered Christ Church school. Here, Mackinder specialized in animal morphology, but he also took courses in physics, chemistry, physiology, and botany. During his last two years he attended classes in geology, history, and law.

At the university he was involved in a wide range of school-related activities. He spent a lot of time in the laboratories and the University Museum. He joined the Union and helped found the Junior Scientific Club in 1882. In the same year he enlisted in the Oxford University Army Volunteer Reserve. During the summer vacations, he often took part in exercises and long marches across the countryside. Another interest related to the military was his affinity for war games and his membership in the Kriegsspiel Club. There he met many other people who later would be of importance to him. Among those at Oxford was Herford George, who taught military history. He wrote on the relationship of history and geography and on the historical ge-



ography of the British Empire. And it was George who later proposed Mackinder for membership in the Royal Geographical Society in 1886.

In a paper entitled “The Scope and Methods of Geography” that he wrote for the Royal Geographical Society, Mackinder outlined his ideas of a “New Geography.” He defined geography as “the science of distributions” based on a biological tradition in which forces interconnect and play upon each other. As a result of the paper, Mackinder is sometimes labeled as an environmental determinist. It was his conviction that physical and human geography formed one subject, and he consequently drew the conclusion that history and geography can never be studied separately.

In addition to his educational work, Mackinder also planned the first ascent of Mount Kenya. In 1896, the same year the Uganda Railway started, Mackinder received permission for the expedition to Kenya. In Kenya, the group had to face many problems, such as an outbreak of smallpox and a famine. Nevertheless the expedition to East Africa turned out to be a great success.

In 1904, he presented his well-known paper “Geographical Pivot of History” at the Royal Geographical Society. He wrote that “my aim will be to exhibit human history as part of the life of the world organism.” Moreover, he argued that sea power was declining relative to land power, and railroads led the way to continental areas. His thesis, widely known as Mackinder’s Heartland Theory, suggests that there was a pivotal area “in the closed heartland of Euro-Asia,” which was most likely to become the seat of world power because of its inaccessibility. His theory was more or less a model based on world history and geographical facts. Mackinder defined a “world island” that consisted of the two continents Eurasia and Africa. He saw history as a struggle between land-based and sea-based powers. He saw that the world had become a closed system, with no new lands left for the Europeans powers to discover, to conquer, and to fight over without affecting events elsewhere.

Sea- and land-based powers would then struggle for dominance of the world, and the victor would be in a position to set up a world empire. The determining factor in this struggle was geography. The world, he argued, was now a closed political system and a world-view had to be taken.

Mackinder’s geographical work was often criticized as being too political, and his scientific reasoning was often accused of being too primitive. In brilliant lectures he expounded the principles of the “new” ge-

ography by synthesizing the study of the physical landscape and human activity within a historical context. According to Mackinder there are three correlated arts that he thought were characteristic of geography: observation, cartography, and teaching. Mackinder always pushed for the founding of a geographical institute in London, and in 1893 he became involved in the founding of the Geographical Association to stress the necessity of teaching geography in schools. Mackinder’s contribution to the founding of Reading University is considered one of his most important achievements.

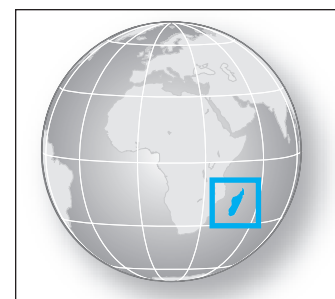
Finally, Mackinder was convinced that geography was a distinct discipline with its own methodology, thus deserving its own place within the academic world.

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## Madagascar

**Map Page** 1116 **Area** 364,500 square mi (587,040 square km) **Population** 17,501,871 **Capital** Antananarivo **Highest Point** 9,435 ft (2,876 m) **Lowest Point** 0 m **GDP per capita** \$800 **Primary Natural Resources** chromite, coal, bauxite, salt, quartz.



**MADAGASCAR, THE WORLD'S** fourth-largest island, after GREENLAND, New Guinea, and BORNEO, is located 250 mi (400 km) off the southeast coast of Africa. The climate is temperate, with average temper-

atures ranging between 48 degrees F (8 degrees C) and 81 degrees F (27 degrees C). The island coastal region is tropical with a rainy season that extends from November through April.

The island of Madagascar has been described as an “alternate world” or a “world apart” because of the uncommonness of many of its plant and animal species. Most life forms on the island have an African (or South American) origin. Millions of years of isolation have allowed old species, elsewhere extinct, to survive and new species unique to the island to evolve. A great number of plant, insect, reptile, and fish species are found only in Madagascar. Madagascar once was covered almost completely by forests but has been deforested by the practice of burning the woods to clear the land for dry rice cultivation. Wood and charcoal from the forests are used to meet 80 percent of domestic fuel needs. As a result, fuel wood is in short supply. Rainforests survive on the hillsides along a slender north-south border on the east coast. Secondary growth, which has replaced the original forest and consists to a large extent of traveler’s trees, raffia, and baobabs, is found in many places along the east coast and in the north.

The landscape of the central highlands and the west coast is savanna or STEPPE, and coarse prairie grasses grow where erosion has not taken over. The remaining rainforest contains a great number of unique plant species. The country has some 900 species of orchids. Banana, mango, coconut, vanilla, and other tropical plants grow on the coasts, and the eucalyptus tree, brought from Australia, is prevalent.

Madagascar was once an independent kingdom but became a French colony in 1896. It regained its independence in 1960. The current system of government is that of a republic. A constitution was adopted through a referendum vote on August 19, 1992, and free elections were held in 1992 and 1993, ending 17 years of single-party government. Madagascar’s independence encouraged the practice of economic privatization and liberalization. This strategy has placed the country on a slow and steady growth path from a 71 percent poverty level.

Agriculture, including fishing and forestry, is the driving economic force of the economy, accounting for more than one-quarter of gross domestic product and employing four-fifths of the population. Other predominant industries on Madagascar are meat processing, soap making, breweries, tanneries, sugar, textiles, glassware, cement, an automobile assembly plant, paper, petroleum, and tourism. The primary agricul-

ture products are coffee, vanilla, sugarcane, cloves, cocoa, rice, cassava (tapioca), beans, bananas, peanuts, and livestock.

The official languages are Malagasy and French although additional regional dialects are spoken. More than half the population follows Animist beliefs (Animism founded upon the belief that the things around us are infused with more than mere existence. Animists believe that the hills, valleys, waterways, and rocks are spiritual beings, as are the plants and animals.) Christianity is practiced by about 43 percent of the population with the remaining being Muslim. There are approximately 20 ethnic groups that make up the population of Madagascar: the central highlanders (Merina and related Betsileo) and côtiers of mixed Arab descent, African, Malayo-Indonesian, Comoran, French, Indo-Pakistani, and Chinese. The life expectancy is 56.54 years of age.

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## Madrid

WITH A POPULATION of 3,092,759 and crossed by the Manzanares River, Madrid is the capital and largest city in SPAIN. Located approximately at the center of the Iberian Peninsula, at the foot of the Sierra de Guadarrama, Madrid has a dry continental climate, with hot summers and cool winters.

After enduring conquest by the Moors in 939 and reconquest by the Christian kings in 1083, Madrid was made the capital only in 1561, becoming the center of the largest world empire of the time. At the beginning of the 17th century, the city lost some of its medieval character (irregular blocks and narrow streets), with the new Plaza Mayor (Main Square) becoming the new center. A great number of churches and convents were built in this period.

Madrid attained a new level of development in the second half of the 18th century, with construction of the Paseo (boulevard) del Prado, the Botanical Garden, and the Puerta de Alcalá; elegant palaces were added by the nobility.

By 1750, Madrid had 160,000 inhabitants and its population density increased until 1850 when 280,000 people were living in a cramped city, calling for urban renewal. Response was the tearing down of the city walls in 1857 and the project of the Ensanche (expansion), originating the neighborhoods of Salamanca, Chamberi, and Arguelles to the north and east, known as Plan Castro of 1870. By the end of the century, construction of Arturo Soria's innovative Linear City was initiated to the northeast as an example of liberal urbanism conciliating urban and rural life. Because of its relative isolation, only in the 19th century did Madrid become the largest city in Spain, becoming a place of production.

In 1910, the Gran Via tore through the city to connect the new large neighborhoods. Madrid was bombed during the Spanish Civil War (1936–39), creating an opportunity to better plan a renewed city and to articulate a ring of peripheral settlements and greenbelts. In the 1950s and 1960s, la Castellana was extended to the north and the area became the new financial and commercial center. Because of its growth and importance, in 1984, Madrid became an Autonomous Community.

### MODERN MADRID

Madrid is today a large and dynamic cosmopolitan city with world-class museums and three large urban parks: the Parque del Oeste, the central Parque del Buen Retiro, and the huge Casa de Campo forest park with its 4,448 acres (1,800 hectares) sprawling to the west of the royal palace. The city is the seat of the government and of the royal family, but despite the importance of services, Madrid keeps relevant industrial activity, producing automobiles, electrical equipment, farming machinery, chemicals, and other goods. A web of expressways and railroads radiate from the city in almost every direction, crossing residential suburbs and industrial areas to connect the capital to all regions of Spain.

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Madrid was made the capital of Spain in 1561, becoming the center of the largest world empire of the time.

## Magellan, Ferdinand (1480–1521)

FERDINAND MAGELLAN, one of the most distinguished explorers in world history, was born in to a middle-class Portuguese family. In his youth, Magellan was awed by Christopher Columbus's seafaring adventures, and he developed a strong interest in the sea and enlisted in the navy in 1505. While serving as a naval officer, Magellan participated in various victorious battles that gave PORTUGAL immense power in the INDIAN OCEAN. One such victory resulted in the conquering of Malacca, which gave Portugal control of vital trade routes in the region.

Magellan traveled on ships that traded throughout the world, studied charts, and listened to tales of great adventures. Magellan was convinced that a water route existed somewhere between the enormous landmass from the North Pole down to South America. He dreamed of one day finding this route and sailing around the world. In 1494, Pope Alexander VI orchestrated the Treaty of Tordesillas, which divided the unknown world. The eastern part of the world was given to Portugal and the western part to SPAIN. However, the





*Though he did not survive the journey, Ferdinand Magellan's expedition set the precedent for success for future explorers.*

treaty's boundaries in the east were virtually unknown, for no one had actually sailed around the world.

Throughout Magellan's naval years, he and the Portuguese king, Dom Manuel developed a particularly strained relationship. He once asked the king for a rise in rank and pay and the king refused. The king also refused to allow Magellan to command a royal ship sailing to the Spice Islands.

Thus, Magellan turned for sponsorship for an epic voyage to the Spanish monarch, King Charles I. He asked for approval from the Spanish king to conduct a voyage, which would possibly create permanent boundaries between Spain and Portugal in the PACIFIC OCEAN. He also wanted to determine whether the Spice Islands were actually within Spain's boundaries. King Charles approved of the plans, and on September 20, 1519, five ships, the *Trinidad*, *San Antonio*, *Concepcion*, *Victoria*, and the *Santiago*, along with a crew of 270 men, set sail on a journey full of mutiny, discovery, and death.

The voyage began with numerous problems. Before departure, the king of Portugal hired secret agents who

loaded empty water barrels onto the ship, and changed the ships' cargo records. When Magellan left Spain, he had mistakenly believed that his ships were fully equipped for the sailing. The five ships were also not of the best quality, and the Spanish crew made plans to lead a mutiny and kill Magellan at sea. While stopping at the CANARY ISLANDS to resupply, Magellan heard of the plans, and subsequently put the conspirators in chains.

On December 13, the five ships landed in the present-day city of Rio de Janeiro, BRAZIL. There, they met the Guarini natives, who believed the men were gods. After a few weeks in virtual paradise, the sailors stocked up on food and water and sailed further south along the east coast of South America, hoping to discover a route to the Pacific Ocean. However, with winter approaching in the Southern Hemisphere, the seas became increasingly treacherous and the weather turned cold and stormy. Many crew members were calling on Magellan to turn back to Rio de Janeiro, but the leader persisted in his quest. After hugging the South American coast for 60 days, through storms and high seas, Magellan instructed the ships to pull into the present-day bay of Port St. Julian.

From Palm Sunday to late August, Magellan and his crew were anchored in the bay. Throughout this period, mutiny was discussed by crew members. A rebellion took control of three of the ships, and 170 out of the 265 men were involved. Magellan ordered numerous executions and marooned mutineers. With these actions, he regained the control and respect of the sailors, however, he lost the *Santiago* in May, after it was wrecked in rough seas while on a reconnaissance mission. Although the ship was destroyed, the 37 crew members were saved.

By October, 13 months after first setting sail, Magellan and his crew once again traveled south along the South American coast. On October 20, they found a beautiful bay that led into a strait. For weeks, the ships navigated their way through the treacherous strait with strong currents, gusty winds, and steep cliffs. The crew on the ship *San Antonio*, however, decided that the risks were too high and actually turned around and headed back to Spain. Unfortunately, this ship carried much of the food and supplies.

On November 28, 1520, the *Trinidad*, *Concepcion*, and *Victoria* entered a vast tranquil sea, which was named the Pacific Ocean. The crew was overjoyed to escape the straits but the excitement was short-lived. Facing nothing but water in front of them and horrid conditions aboard the ship, many of the starving crew



wanted to turn back for Spain. However, Magellan would not turn around and believed the Spice Islands were only a few days away. With the absence of any charts, Magellan's estimates of the proximity of the Spice Islands were not even close, and the three ships continued northward across the endless ocean.

For 96 days, the three ships did not see land as they crossed the Pacific Ocean. They sailed along the peaceful ocean with the aid of trade winds and, unbelievably, missed every single Pacific island. The food supplies and water were dwindling, and the crew was afflicted with scurvy. Many of the crew members were dying, and toward the end of the journey, the men began to eat ox hides and sawdust. Finally, on March 6, 1521, Magellan and his crew landed on present-day GUAM. For three days, the crew made minor repairs and tried to renourish themselves. They set sail again, and on March 16 the crew arrived in the PHILIPPINES. They became the first Europeans to set foot on the islands. For six weeks, the men explored the islands and began to try to convert the islanders to Christianity.

### HOSTILITIES

Some of the indigenous people were hostile toward the spread of Christianity and waged a battle against Magellan and 48 of his men on Mactan Island. While dressed in full battle armor, Magellan was struck and killed by an islander. With their leader now dead, the remaining crew of 115 had to somehow return to Spain. The *Concepcion* was burned, and the *Trinidad*, after being blown off course, was captured by a Portuguese battle group off the coast of JAPAN.

The *Victoria* was now the only remaining ship from the expedition. Sebastián del Cano became the leader, and he and a crew of 47 battled through months of monsoons, heat, and frigid cold. On September 6, 1523, the battered *Victoria* returned to Spain. The remaining crew had dwindled to only 18 Europeans. Although Magellan did not survive the expedition, his glory in Portugal has survived through centuries. The leader of the first expedition to circumnavigate the globe traveled to where no European had been before and set a precedent of success for future European explorers.

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## Maghreb

BROADLY DEFINED, the Maghreb is the triangular region of northwest Africa bounded by the ATLAS MOUNTAIN ranges, the ATLANTIC OCEAN from the border of western SAHARA to the Strait of Gibraltar, and the MEDITERRANEAN SEA from the Strait of Gibraltar to the northeast of LIBYA. Politically, the Maghreb includes the countries of MOROCCO, ALGERIA, TUNISIA and sometimes LIBYA. In the Middle Ages, Moorish SPAIN was included in the Maghreb. The Maghreb (*maghrib*) is Arabic for "the west." The original Arabic name for the northwestern end of the African continent was Maghreb-el-Aqsa, "the land farthest west," or "the place where the sun sets."

The Maghreb is watered by westerly winds from the Atlantic Ocean. Ninety-five percent of the people of the Maghreb countries live between the Atlantic or Mediterranean coasts and the Atlas Mountains.

In the Moroccan part of the Maghreb, the Mediterranean coast is rugged with cliffs and coves. The Rif Mountains rise sharply from the Mediterranean to a height of 7,218 ft (2200 m). The Taza Gap runs east and west between the Rif Mountains and the Middle Atlas ranges to link Algeria with Morocco. Southeast from the Strait of Gibraltar are the Middle Atlas (Moyen Atlas) Mountains. Much of the area is high, partially forested plateaus. Farther south the High Atlas (Haut Atlas) Mountains reach to some of the highest peaks in Africa. Winter snows frequently cover the 400-plus mountaintops that exceed 9,850 ft (3,000 m). The highest peak is Mount Toubkal at 13,665 ft (4,165 m).

The Algerian part of the Maghreb has four east-west zones. The coast stretches from Morocco 600 mi (970 km) to Tunisia. It extends inland from 50 to 120 mi (80 to 190 km). The coastal zone is a lowland strip dotted with mountains. The region is fertile and called the "Tell" in Arabic. The zone of the Tell Atlas Mountains (highest point about 7,570 ft or 2,310 m) is south of the coastal zone. South of the Tell, is a semiarid region of plateaus (average elevation is about 3,500 ft or

1,070 m) containing a number of shallow salt lakes (chotts). These wet-season lakes dry into salt pans during the dry season. A fourth zone holds the semi-arid Saharan Atlas Mountains, a broken series of mountain ranges and massifs.

### TUNISIAN MAGHREB

The Tunisian area of the Maghreb contains two branches of the Atlas Mountains that extend eastward across the country from Algeria. Along the coast is a fertile plain. The northern range lies inland a short distance and is called the Atlas Mountains. Most of the mountains are low with peaks under 2,000 ft (610 m) in all but a few locations. The Tabassah Mountains form the southern Atlas branch of the Tunisian Maghreb. The highest is Mount Shanabi at 5,066 ft (1,544 m). The area includes the Grand Dorsal Range and the two-mile-wide Kasserine Pass. South of the Tabassah range the elevation descends across a plateau with salt lakes and date palm oases to the SAHARA DESERT.

The northwestern plain of Libya and the northeastern highland, an extension of the Atlas ranges, across the Gulf of Sidra are sometimes included in the Maghreb, for reasons of culture, if no other.

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## Magna Graecia

MAGNA GRAECIA (or "Greater GREECE") was the geographic expression of Greek colonization originating from many different Greek cities. It was a process that began in the 7th century B.C.E., largely because of overpopulation. Competing city-states such as Sparta, Corinth, and Athens began to found new cities (colonies) that, in turn, became centers of an economi-

cally thriving and internally competitive expansion of Greek culture. These new colonies were concentrated south from the Bay of Naples to the Gulf of Taranto and along the southern and eastern coasts of Sicily in the MEDITERRANEAN SEA. Because these colonies remained closely linked to their home cities in Greece proper, they together were known as Magna Graecia.

Despite the existence of earlier trading colonies established by the Phoenicians, Greek mythology and folklore eventually asserted the greatest influence on Sicily. In the 7th, 8th, and 9th centuries B.C.E., Sicily and the southern part of the Italian peninsula (today the poorest areas in ITALY) were colonized by Greeks, and it is claimed that the area boasted more Greeks and Greek temples than homeland Greece itself. This process dispersed Greek culture and arts throughout the central and western Mediterranean.

### EARLY CONTACTS

Unlike Greek Sicily, Magna Graecia on the Italian peninsula began to decline by 500 B.C.E., probably because of malaria and endless warfare among the colonies, but certainly with the onslaught and emergence of the Roman Empire. Culturally, Magna Graecia also was the center of two philosophical groups in the 6th century B.C.E., Parmenides, who was at Elea, and Pythagoras (originally from Samos), who resided at Croton. And it was through contacts and trade with Magna Graecia that the Etruscans and the Romans first came into early contact with Greek civilization, especially its pottery and the practice of minting coins.

The chief city colonies of Magna Graecia (and their home city) were Tarentum (colonized by Spartans); Heraclea (by people from Tarentum); Metapontum (settled by Achaeans); Sybaris (Achaean immigrants) and then known as Thurii (settled by Athenians who replaced earlier colonists from Sybaris); Paestum, or Posidonia (settled by people from Sybaris); Laos (also settled by people from Sybaris); Siris (migrants from Colophon); Caulonia (people from Crotona); Epizephyrian Locris (settlers from Locris); Hipponium (migrants from Epizephyrian Locris); Cumae (people from Chalcis); Rhegium (now Reggio de Calabria, settled by people from Chalcis); Neapolis (now Naples, earliest people came from Cumae); and Elea (migrants came from Phocaea in Ionia).

It is amazing to historians and geographers that Magna Graecia, once a center of immense wealth and culture geographically, was concentrated in what today many consider to be the poorest and most backward areas of Italy.

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## Maine

MAINE IS THE easternmost state in the UNITED STATES and the northernmost of the 48 contiguous states. It is bounded to the east and south by the ATLANTIC OCEAN, to the northeast by the Canadian Province of New Brunswick, and to the northwest by the Canadian Province of Quebec. To the west, Maine is bordered by the U.S. state of NEW HAMPSHIRE.

Of the six New England states, Maine has by far the largest area, consisting of 33,215 square mi (86,026 square km). The state's famous rocky coast was shaped by glacial activity more than 12,000 years ago. The receding glaciers left behind thousands of islands, bays, and coves, resulting in 3,500 mi (5,632 km) of shoreline. For all its size, Maine has a low population density—there are only 1.3 million inhabitants, most of whom are concentrated in the south. Portland is the largest city, with a population of 64,000. Augusta is the capital. Other major urban areas include Bangor and Lewiston.

Maine is called the Pine Tree State. In its interior are 17 million acres (6.8 million hectares) of forest. While much of the northern forest areas are privately owned, there are many protected areas scattered throughout the state. Among them, Acadia National Park is a popular tourist destination. Other major recreational areas include the Allagash Wilderness Waterway and Baxter State Park.

Most visitors to the state enjoy the sandy beaches along the southern coast, between Kittery and Portland. Inland, there are approximately 6,000 lakes and ponds, and there are rugged, mountainous areas to the west. Of note, Moosehead Lake is the largest body of water wholly contained by any state, and Mt. Katahdin (the northern terminus of the Appalachian Trail), at 5,268 ft (1,605 m), is the state's highest peak. Maine typically sees short summers (with warmer

weather along the southern beaches and cooler weather inland) and cold winters. The beach season typically starts in July and runs through early September.

The more remote, undeveloped areas of the state include the "Downeast" region along the upper shore in Washington County. The largely rural Aroostook County lies in the far north of the state. Maine was first settled as early as 3000 B.C.E., although little is known about these first inhabitants. Later, Native American tribes settled there, included the Micmacs, Abnakis, Passamaquoddies, and Penobscots. The first Europeans to explore Maine's coast may have been the Norse Vikings, in the 11th century; later, in the 1490s, Englishman John Cabot may have visited, although neither claim has been proven. Throughout the 1500s, English and French ships visited briefly, and in 1607, a group of English tried, and failed, to establish a colony. Permanent settlers did not arrive until the 1620s.

There is no consensus on the origin of the state's name, which first appeared in 1622. It is commonly believed that the name was used to refer to the mainland, distinguishing it from the numerous islands along the coast. The area later became part of the Massachusetts Bay Colony. Throughout the 1700s, area settlers experienced near continuous warfare, with both the native inhabitants and with the French. Because of its long coastline, Maine suffered from British sea attacks during the Revolutionary War. After the war, Mainers began to clamor for statehood, which was not realized until March 15, 1820, when Maine became the 23rd state as part of the Missouri Compromise—a Congressional policy aimed at preserving the balance between slave and free states. As part of that agreement, Maine was admitted to the Union as a free state, and Missouri as a slave state a year later. A strong abolitionist movement sprang up in Maine during the 19th century, and the state sent thousands of young men to fight in the Civil War. The state enacted prohibition laws in 1846 that lasted until the end of national Prohibition in 1934.

Maine's top agricultural commodities are potatoes, dairy products, eggs, seafood, and blueberries. The state is renowned as a source of fresh lobster, yielding 57 million pounds (25 million kg) of these saltwater crustaceans in 2000. In recent years, the state has experienced losses in its traditional base of manufacturing jobs. Tourism is now the primary industry, driven by an increasing number of visitors to the state's quaint coastal villages, rugged coastal headlands, and inland recreational areas. Because of their relative isolation

and distance from the rest of the nation, Mainers (sometimes called “Mainiacs”) have staked out a reputation as a self-reliant, traditional people.

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## Malacca Straits

A PLAQUE IN THE gardens of the sultan's palace in Melaka reads: “Whoever is lord of Malacca has his hand on the throat of Venice.” For centuries this passage of water, 620 mi (1,000 km) long, connecting the INDIAN OCEAN and the South China Sea, running generally northwest to southeast, lived up to this reputation as one of the most important TRADE ROUTES in the world, the meeting place of east and west that influenced the economies of states as far away as Venice, ITALY. The straits flow between the Malay Peninsula and the island of SUMATRA, ranging in width from 9.2 to 125 mi (14.8 to 233 km).

The narrowness of these straits, combined with their economic importance as the shortest sea route between three of the world's most populous countries—INDIA, CHINA, and INDONESIA—makes them one of the most strategic economic zones in the world today.

The first major empire in Southeast Asia, the Srivijaya, based its power on control of the straits in the 7th century. Located roughly at the midway point between INDIA and China, the straits drew traders from both of these nations who established settlements along its banks. Attracted mainly to the spices of the east but also to trade in hardwoods, silks, porcelain, slaves, and exotic animals, Arab traders arrived in the area, followed by Portuguese and Dutch traders.

The city of Melaka ultimately became a British possession, along with the important island trading settlements at the northern and southern ends of the straits, Penang and SINGAPORE. In 1824, these settlements were joined together by the British East India Company to form the Straits Settlements Colony (with its capital at Singapore). The Dutch East India Com-

pany controlled the southern shores of the straits (on the island of Sumatra) but were never able to consolidate a counterbalance to British control because of the swampiness of this coast and the ongoing difficulties they encountered with the local sultanate of ACEH.

### MORE TRAFFIC

The opening of the Suez Canal in 1869 created even more traffic in the straits, and British Singapore developed into one of the world's major trade ENTREPOTS, rivaling Spanish Manila and Dutch Jakarta. Ships from Europe, India, and China had to pass by Singapore, and early on it was a free port, unlike its colonial rivals. The northern coast of the straits was transformed by the British into rubber plantations and settled by thousands of Chinese and Indian workers. This area still has one of the greatest concentrations of Indians outside of South Asia. Another big industry stimulated by the British was tin because of the close proximity of its source in the Main Range to the coast (about 25 to 30 mi or 40 to 50 km).

The northern coast of the straits, hemmed in by this mountain range, has only about a quarter of the land of the Malay Peninsula, but 85 percent of all economic activity, and the 10 largest cities, including the capital of MALAYSIA, Kuala Lumpur, and its port city, Kelang. Singapore is mostly populated by Chinese, and continues to dominate trade in the region. The southern coast, now part of Indonesia, remains largely undeveloped. Both coasts of the Malacca Straits are mostly unbroken mangrove swamps and mudflats, with a few bays that shelter coconut palms.

Today, the Malacca Straits are considered one of the world's oil transit CHOKES, with an estimated 11 million barrels per day passing between its shores from the MIDDLE EAST to JAPAN, China, and the rest of the Pacific Rim. Some 900 ships per day (or 50,000 per year, carrying nearly \$1 trillion in goods) pass through this natural choke point bottleneck, with significant potential for disaster from collisions and spills, piracy, and terrorism. The straits also support large fishing and tourism industries, which are also threatened by shipping accidents and oil spills.

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## Malawi

**Map Page** 1116 **Area** 45,745 square mi (118,480 square km) **Population** 12,000,000 **Capital** Lilongwe **Highest Point** 9,843 ft (3,002 m) **Lowest Point** 105 ft (37 m) **GDP per capita** \$220 **Primary Natural Resources** almost entirely agricultural.



MALAWI IS A SMALL, landlocked country in central southeastern Africa. It is about the size of LOUISIANA or somewhat larger than CUBA. Like Cuba, Malawi is long and narrow. It stretches north to south for about 520 mi (835 km). It is only 50 to 100 mi (80 to 160 km) wide. Malawi's borders MOZAMBIQUE on the east, south and west. Its western border is with ZAMBIA and TANZANIA lies to the north. Most of Malawi's eastern border is Lake Nyasa (called Lake MALAWI in Malawi), opposite Mozambique in the south and Tanzania in the north.

The east African Rift Valley cuts through the central African plateau for the whole length of Malawi from south to north. The Rift Valley creates Malawi's two most prominent features: Lake Nyasa and the adjacent plateaus. Lake Nyasa fills much of Malawi's part of the Rift Valley. The lake's surface is about 1,500 ft (472 m) above sea level. The lake's shoreline is a flat plain with many swamps. The Songwe River feeds Lake Nyasa in the north. The Shire River, the outlet for Lake Nyasa, flows south through Lake Malombe to join the Zambezi River as a tributary.

### PLATEAUS AND HIGHLANDS

Plateaus cover about three-fourths of Malawi's land area. The plateaus have a varied terrain that includes plains, rounded mountains, inselbergs ("island mountains"), and forests. West of Lake Nyasa is a broad plain on top of the central plateau region. It averages between 3,000 and 4,000 ft (900 and 1,200 m) in height. The Dedza highlands on the southwestern edge

of the central plateau border Mozambique. In the north are the Chimaliro Hills and the Viphya Highlands. The north's unique Nyika plateau section reaches an elevation of about 8,000 ft (2,400 m). South of Lake Nyasa on the eastern side of the Shire River are the Shire Highlands. This plateau region holds Malawi's (and Central Africa's) highest point, Sapitwa (Mount Mlanje).

Malawi's climate is subtropical, with a rainy season (November to May) and a dry season (May to November). The dry season is much cooler than the rainy season. The highlands are much wetter and cooler than the lowlands. Rainfall in the highlands is about 90 in (230 cm) a year. In the Shire River Valley the rain is about 30 in (80 cm) per year. Temperatures in Malawi are affected by the season, altitude, and latitude from the south to north.

Temperatures are hottest in the Shire River Valley just before and after the rains. Cooler temperatures occur in the higher elevations. Malawi's ancient volcanic soils are very fertile. This has encouraged extensive agricultural activity as the basis of the economy. Most of the people of Malawi are Bantu speaking; English and Chichewa are both designated official languages. Since July 6, 1964, Malawi has been an independent republic.

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## Malawi, Lake

LAKE MALAWI IS LOCATED in southeastern Africa lying within the crease where the eastern and western branches of the Great Rift Valley meet. According to the Center of Great Lakes Studies, Lake Malawi is the ninth-largest lake in the world by area and the fifth-largest lake in the world by volume. Malawi is the third-largest lake in Africa, covering 11,600 square mi (30,044 square km), and is 375 mi (603 km) long and

from 15 to 54 mi (24 to 87 km) wide. The lake is at 1,550 ft (471 m) elevation and reaches a maximum depth of 2,487 ft (758 m). It is bordered on the south and west by the country of MALAWI, on the north and east by TANZANIA, and by MOZAMBIQUE to the east. The Malawi-Tanzania border follows the northeastern shoreline of Lake Malawi. The Malawi-Mozambique border runs along the center of the southern part of the lake, with the exception of the islands of Likoma and Chisumulu, which belong to Malawi. Likoma is the largest island on the lake.

The lake is a major tourist destination in this part of Africa, and many resorts have been developed along the southern shores of the lake, where the water is shallower and there are many beautiful white sandy beaches. With the exception of the southern portion of the lake, steep mountain slopes surround Malawi. The Livingstone Mountains rise from the northeastern shore of the lake and are covered by dense forests. Along the north shore of the lake grow thick beds of papyrus reeds, which are the nesting grounds for several species of birds, including kingfishers, cormorants, fish-eagles, and numerous others.

Other inhabitants of the lake include hippopotamuses and crocodiles. Much of the lake's economy is based upon tourists and fishing. The natives that live around the lake bring in over 7,000 tons of fish per year. Most of the fish is dried and used locally, but some of it is exported.

From the north in Tanzania, Lake Malawi is fed by the Ruhuhu River and from the west three small mountain streams, Bua, Dwangwa, and Songwe, feed the lake. The Shire River flows out of Lake Malawi at its southern end and is a tributary of the great Zambezi River. The Shire is greatly affected by the level of the lake, which varies by up to 20 ft (6 m). These changes in water level have been studied and, because they occur every 11 years, are believed to be linked to the sunspot cycle.

Lake Malawi could also be known as the lake with many names. Prior to the 18th century, the lake was known as Zafan, Zambre, Hemozura, and Lake Maravi. In 1859, David Livingstone was the first European to map Lake Malawi. At that time, it was named by Livingstone as Lake Nyasa, which was its native name meaning simply "lake."

In 1964, Nyasaland, formerly a British Commonwealth, became the fully independent country of Malawi, and Lake Nyasa became Lake Malawi to the Malawi people. In Mozambique, they still call the lake Niassa, according to the Portuguese spelling of Nyasa.

In literature, it is called Lake of Stars, for the sun glittering off the lake during sunset, and Lake of Storms, for the unpredictable and extremely violent gales that sweep through the area.

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## Malaysia

**Map Page** 1124 **Area** 127,316 square mi (329,750 square km) **Population** 23,522,482 **Capital** Kuala Lumpur **Highest Point** 13,450 ft (4,100 m) **Lowest Point** 0 m **GDP per capita** \$4,530 **Primary Natural Resources** tin, petroleum, timber, copper, iron ore.



MALAYSIA IS LOCATED in the heart of Southeast Asia and is divided into two geographical sections: Peninsular Malaysia and the East Malaysian provinces of Sabah and Sarawak, which are located in northern BORNEO, some 403 mi (650 km) across the South China Sea. Malaysia's peninsular neighbors are THAILAND to the north and the island country of SINGAPORE in the south. The Andaman Sea and the MALACCA Straits are on the west coast of Peninsular Malaysia, while the South China Sea borders both the east coast of Peninsular Malaysia and the East Malaysian provinces of Sabah and Sarawak. Sabah and Sarawak border Kalimantan (the Indonesian part of Borneo) and Sarawak surrounds the tiny enclave of BRUNEI. Because of Malaysia's location on a peninsula, it has 2,900 mi (4,675 km) of coastline.

### GEOGRAPHY

Peninsular Malaysia's 50,580 square mi (131,000 square km) accounts for 40 percent of the country's landmass. There are several mountain ranges running north to south along the backbone of the peninsula,

and a narrow causeway that connects it with Singapore to the south. A wide, fertile plain extends along the West Coast next to the Malacca Straits, while a narrow coastal plain runs along the east coast next to the South China Sea.

East Malaysia (76,458 square mi or 198,000 square km) lies east of Peninsular Malaysia across the South China Sea and occupies a broad strip running from the westernmost to the northernmost tip of the island of Borneo. Dense jungles and tropical RAINFORESTS cover East Malaysia. Because of the rugged conditions, most of the local natives use the large river networks as the main means of transportation.

Malaysia is hot and humid all year round and over 60 percent of the country is considered to be rainforest. The east coast of Peninsular Malaysia has a distinct rainy season because of the monsoon climate. The wettest season on the west coast of the peninsula is between September and December, while on the east coast and in Sabah and Sarawak, the rainy season comes between October and February. The rains often come in short, strong bursts where the water seems to come straight down as if being poured out of a bucket. When they just as quickly disappear, the humidity level soars and you wish for another rain.

## PEOPLE

As the economy develops, Malaysia is becoming more and more urban, with cities accounting for 40 percent of the total population. The principal urban concentration is in the Klang Valley, around the capital city of Kuala Lumpur (1.4 million), where the population has been growing annually at a rate of 7 percent. Peninsular Malaysia is also more heavily populated than East Malaysia with nearly 85 percent of the country's total population. Malaysia is also a very young country, with 38 percent of the total population under the age of 15 and only 4 percent over the age of 65. Malays and other indigenous ethnic groups (together known as Bumiputras) account for 59 percent of the population, the Chinese 24 percent and Indians 8 percent. The official language is Bahasa Malaysia (Malay), but English still predominates in industry and commerce. The official religion of the country is Islam, but there is freedom of worship.

## ECONOMY

Malaysia has historically been an exporter of primary products such as rubber, tin, palm oil, and timber. Malaysia has long been an important exporter of palm oil (50 percent of world production), generating ex-



*Malaysia's capital city of Kuala Lumpur (1.4 million) has a population that has been growing annually at a rate of 7 percent.*

ports of about \$2 billion annually. In the mid-1970s export manufacturing, in particular of textiles and electronics, began to develop, based on an accommodative government attitude toward incoming foreign investment and a skilled low-cost labor force. As a result, Malaysia has become one of the world's three largest manufacturers of semiconductors and air conditioners. Malaysia's economy has enjoyed very positive real annual growth during the last decade, with the manufacturing sector contributing more than 40 percent of the total growth, and the finance, agriculture, and transport sectors each contributing about 10 percent. Malaysia is often cited as one of the Asian Tigers because of its relatively high gross domestic product per capita. The key industries in Peninsular Malaysia include rubber and oil palm processing and manufacturing, light manufacturing industry, electronics, tin mining and smelting, and logging and processing timber. Sabah in East Malaysia is known for its logging and petroleum production, while agricultural processing, petroleum production and refining, and logging are done in Sarawak.

## HISTORY

Because of the Malacca Straits, which provide an inside passage from the South China Sea to INDIA, Malaysia has been a strategic factor in trade for thousands of years. From the 900s on, there were numerous Chinese and other settlements established to support the great sailing fleets moving goods between Asia, India, and the MIDDLE EAST. With the formation of the Dutch East India Company, the region became a stronghold for



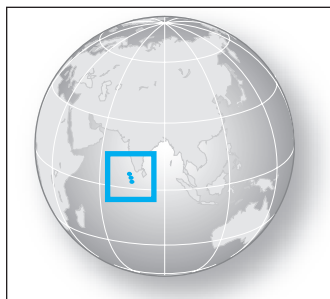
Europeans trying to protect their interests in the highly profitable spice trade and ultimately led to the founding of SINGAPORE. In 1957, the Federation of Malaya, comprising the 11 states of Peninsular Malaysia, gained independence from the UNITED KINGDOM. The federation became known as Malaysia with the accession of three further states, Singapore, Sarawak, and Sabah, in 1963. In August 1965, Singapore withdrew from the federation to become an independent sovereign state. Malaysia is a federal constitutional monarchy. Its head of state is the king, who is elected for a five-year term by the nine hereditary sultans of the eleven states of Peninsular Malaysia.

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## Maldiv Islands

**Map Page** 1123 **Area** 115 square mi (300 square km)  
**Population** 329,684 (2003)  
**Capital** Malé **Highest Point** 7.8 ft (2.4 m) **Lowest Point** 0 m  
**GDP per capita** \$3,900  
**Primary Natural Resources** coconuts, corn, sweet potatoes, fish, tourism.



THE COUNTRY OF THE Maldiv Islands is located in southern Asia, in the INDIAN OCEAN, as a group of atolls south-southwest of INDIA. This remote island nation is comprised of 1,191 coral islands amid major shipping routes in the Indian Ocean. Archaeological evidence of settlement from South Asia is datable to around 500 B.C.E. The native language of Dhivehi points to Sri Lanka as the source of the Maldives' earliest continuous cultural roots. The details of the con-

version of the Buddhist king to Islam is wrapped in legend but venerated as the key point of the islands' history. In 1153, the king adopted Islam and thereupon the title of Sultan Muhammad al Adil. This initiated a series of six dynasties consisting of 84 sultans and sultanas that lasted until 1932, when the sultanate became elective.

For the vast bulk of its sultanate history, the Maldives remained independent. Only in the 16th century did the Portuguese first come upon the Maldives in pursuit of the spice trade. In 1558, the Portuguese invaded Malé only to be ejected 15 years later. The vying colonial powers continued to supplant one another. In the mid-17th century, the Dutch controlled the spice trade but put no colonial government in the Maldives. The British moved the Dutch aside, and by 1887, it officially made Maldives a British protectorate, leaving internal affairs to be managed by the sultan.

During the 1950s, British military activity dominated Maldivian economics and politics. In 1956, the British gained license to reestablish its wartime airfield on Gan Island at very concessionary terms. Newly elected Prime Minister Ibrahim Nasir questioned this agreement and called for official review. Peoples of the southern atolls and leaders who benefited most from the British presence started a secessionist movement to establish an independent state. In 1962, Nasir sent government police to successfully suppress this insurrection. Nasir also renegotiated the terms of the lease of the airfield at Gan.

On July 26, 1965, the Maldives gained independence from Britain. Three years later they voted to abolish the sultanate and established a republic. Ibrahim Nasir dominated politics for the next 10 years until he fled the country for SINGAPORE, taking more than his share of the nation's wealth.

Economic downturns in the fishing industry and the British decision to close the airbase on Gan in 1975 were great challenges for the government. A former college lecturer and ambassador, Maumoon Abdul Gayoom was elected president in Nasir's place. Gayoom has been in power since 1978, surviving three coup attempts and remaining popular with the Maldivian people.

Recent years have seen continuing economic growth and modernization. This growth has been primarily in the tourist industry with profits going to improve other sectors as well. The Maldives have been the recipient of generous and consistent foreign aid. There remains a tension between the progressive nature of the tourist industry and the conservative tone of



a traditional Muslim way of life. Sustained use of the marine resources in the tourist and fishing industry are a continuing challenge.

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## Mali

**Map Page** 1113 **Area** 478,640 square mi (1,240,000 square km) **Population** 11,626,219 **Capital** Bamako **Highest Point** 3,789 ft (1,155 m) **Lowest Point** 75 ft (23 m) **GDP per capita** \$900 **Primary Natural Resources** gold, phosphates, kaolin, salt, limestone.



A LANDLOCKED REPUBLIC and the largest country in West Africa, Mali is bordered by ALGERIA to the northeast, MAURITANIA to the northwest, SENEGAL and GUINEA to the west, CÔTE D'IVOIRE and BURKINA FASO to the south, and NIGER to the southeast. The capital, Bamako, is by far Mali's largest city, though there are a number of smaller urban areas that include Kayes, Sikasso, Segou, Mopti, Djenné, Timbuktu (Tombouctou), and Gao.

Mali's climate is one of the harshest in Africa, as most of the country is arid or semi-arid: only 4 percent of the country is arable land. Three major rivers run through Mali: the Niger and the Bani meet at Mopti in the center of the country, and the Senegal in the southwest.

Mali's population is among the most ethnically diverse in Africa and is divided geographically north to south. Mande peoples (Bambara, Malinke, Soninke) in the south make up half of Mali's population; the central areas contain largely Peuls/Fulanis (17 percent) Voltaic peoples (12 percent), and the Songhai (6 percent); and the northern desert is largely occupied by the Tuareg and the Moors (10 percent). The remaining 5 percent consist of minuscule ethnic groups scattered throughout the country. Ninety percent of Mali is

Muslim, 9 percent practice indigenous religions, and 1 percent is Christian. French is Mali's official language, though Bambara is also widely spoken.

Mali has consistently ranked amongst the poorest countries in the world. The country imports most basic resources because of lack of farmland and consistent water sources. While Mali is mineral-rich, economic woes and political struggles have prevented most of those materials from being fully exploited.

### HISTORY OF MALI

Mali's history is among the most ancient in the world, with evidence of civilization from the 11th century B.C.E. Mali was also the seat of the great African trade empires of GHANA, Mali (for which the country is named), and Songhai from the 6th to the 16th century, and its political and economic dominance in West Africa is well documented by Arab geographers, European travelers and local historians.

Mali fell into virtual anarchy after the destruction of the Songhai Empire in the late 16th century. The region was briefly united under the Tukolor Empire in the mid-19th century, then was conquered by the French between 1893 and 1898. Mali became part of French West Africa until 1958, though it gained total independence in 1960.

Mali since independence has experienced considerable political and economic instability. The country became a one-part socialist state and tried to separate economically from France, which caused a financial crisis during the 1960s. During the chaos that resulted, Moussa Traoré installed himself as dictator in 1968. Severe droughts in the 1970s destroyed Mali's delicate economy, and led to unrest and escalating conflicts with Burkina Faso and the Tuareg ethnic minority in the north during the 1980s and 1990s.

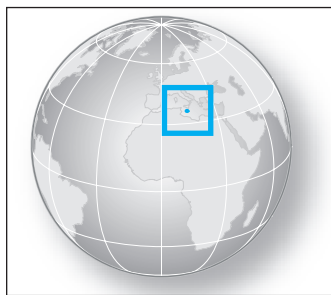
Though Traoré was ousted by a coup in 1991, Mali did not establish a true multiparty republic until the elections of 2002. Amadou Touré, a former interim military ruler, became Mali's first unopposed elected president.

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## Malta

**Map Page** 1131 **Area** 122 square mi (316 square km) **Population** 400,420 **Capital** Valletta **Highest Point** 830 ft (253 m) **Lowest Point** 0 m **GDP per capita** \$10,434 **Primary Natural Resources** globigerina limestone, petroleum, tourism.



THE COUNTRY OF MALTA, which calls itself the Repubblika Ta' Malta, is an archipelago made up of five islands: Malta, Gozo, Comino, Cominotto, and Filfla, as well as two small islets known together as St. Paul's Islands. Only the first three, Malta, Gozo, and Comino, are inhabited. Malta is near the center of the MEDITERRANEAN SEA, 58 mi (93 km) south of Sicily and 179 mi (228 km) north of LIBYA, although its latitude is south of Tunis. It is about midway between GIBRALTAR and Tel Aviv, ISRAEL, at the opposite end of the Mediterranean. The main island of Malta is farthest east, and, in parts, is densely populated. On its southeast is the Grand Harbor, which made it an attractive port for the ancient Phoenicians, Carthaginians, and Romans for centuries. Today it is considered an underdeveloped area of fishing villages.

None of the islands have permanent lakes or streams, and 70 percent of the water used on Malta comes from desalinization plants. Malta has a high population density, particularly in the areas near its largest city, Birkirkara, and its capital, Valletta, both located on the northeast section of Malta Island. Malta's tourism industry is fueled by its beaches and mild climate and by its historical sites. Tourism accounts for one-quarter of Malta's gross domestic product, and the islands host over 1 million visitors per year. Many come to enjoy 85 mi (137 km) of beaches and year-round sunshine; Malta's average monthly temperature ranges from 54 to 88 degrees F (12 to 31 degrees C). Diving, windsurfing, sailing, and other sports attract visitors year round.

Megaliths and religious temples from the 4th millennium B.C.E., predating the rise of Sumer and EGYPT, have been excavated on Malta and Gozo. Roman temples and villages, walled medieval towns, domed Renaissance churches, and forts built by knights of the Crusades are popular tourist sites. Phoenicia and Carthage maintained ports on Malta for trade until the islands were subsumed into the Roman Empire in 218

b.c.e., after the Second Punic War. In Biblical times, St. Paul was shipwrecked in a bay that still bears his name. From the 6th through the 9th century C.E., Malta was part of the Byzantine Empire, then it passed into Arab hands. In 1090, Normans drove out the Arabs and made Malta an appendage of Sicily. As such, it passed through the ownership of several European kingdoms until 1530. At that point, Charles V of the Holy Roman Empire ceded Malta to the Knights Hospitalers of St. John of Jerusalem, who are sometimes known as the Knights of Malta. Many of the spectacular ruins of Malta were built by this group, which successfully defended the island against Suleiman the Magnificent and the Turkish Empire. Napoleon took over Malta in 1798, and the BRITISH EMPIRE was in control by 1814. The scene of much fighting in World War II, Malta gained independence in 1964.

Malta today is a republic, with an elected president and unicameral legislature and an appointed prime minister. It officially joined the EUROPEAN UNION in 2004. The country is 98 percent Roman Catholic, and the official languages spoken are English and Maltese, a language that developed from North African Arabic and Sicilian Italian.

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## Manila

CONSIDERED TO BE the best harbor in the Far East, known as the "Pearl of the Orient," Manila has been a commercial and cultural hub of the PHILIPPINES, and of Southeast Asia, for over four centuries. Ferdinand MAGELLAN claimed the island of LUZON for SPAIN in 1521, as a strategic point of access to the Spice Islands of the Far East. Manila, on the northwest coast of the island, was captured from its sultan in 1571 and soon became the main exchange point for goods traveling between Macao and Acapulco—silver from MEXICO was traded here for silk from south CHINA. Manila became a rival port to Batavia, the main port of the Dutch East India Company (today's JAKARTA, INDONE-

SIA). By the 17th and 18th centuries, it was essentially a Chinese city, following the pattern of most commercial cities in Southeast Asia, with manual labor provided by Chinese-Filipino or Mexican-Filipino mestizos.

The revolt against Spain in 1896 started here, and the arrival of the UNITED STATES in Manila Bay in 1898 signaled the end of nearly four centuries of Spanish rule. The United States did not depart as planned, however, and maintained a protectorate over the emerging state until it was granted full independence in 1946. American presence remained heavy after independence, however, particularly in the Manila area, because of its large military presence at Subic Bay naval base and Clark Air Force Base, which were given up only in 1992.

The city, originally called Maynilad (“there is *nilad*,” a local white-flowered mangrove), was a Muslim sultanate from the early 16th century. Geographically situated on a plain at the confluence of several mountain ranges, the Laguna de Bay and Manila Bay, it was an obvious location for an urban area that today forms the core of the world’s seventh-largest metropolitan area, with about 10.3 million residents in Manila proper and 16 other cities (including Quezon City, which is actually more populous than Manila and was the capital city from 1939 to 1976). It is an amazing mixing bowl of cultures, combining elements of Spanish, Chinese, English, and Tagalog culture.

The city is centered on both sides of the Pasig River, where it enters Manila Bay. The old walled city, or Intramuros, is on the southern, or left, bank of the river. It consists of old Spanish houses, churches and convents, and narrow streets and is surrounded by a defensive wall, built around 1790 to defend against attacks from the Dutch and British. The old town also includes the old city hall (Ayuntamiento) and the University of Santo Tomás, founded by the Dominican Order in 1605. The city’s other major university, and the oldest in Asia, is the University of the Philippines, founded by King Philip II of Spain in 1585.

North of the river lies the Binondo section, Manila’s Chinese commercial district, famous for its wild bargain basement bazaars in the Divisoria. Nearby is the old governor’s palace, Malacañang, now the residence of the Philippine president. North and south of the river the city spreads out in newer neighborhoods, including Ermita and Malate, the center for tourist hotels, restaurants and nightclubs, and Quiapo, Manila’s congested downtown. As development continued south along the bay, the large Rizal Park was surrounded by more aristocratic suburbs in the 19th



*Manila has been a commercial and cultural hub of the Philippines, and of Southeast Asia, for over four centuries.*

century, and by later American developments, which bear the names of men like President William McKinley and Admiral George Dewey, the victor of the battle of Manila Bay in 1898.

The city has spread out from the bay to join into an urban conglomeration with Quezon City to the north-east and other smaller towns. The language spoken around the bay, Tagalog, has become the official national language, though English is the lingua franca used in many of the southern islands. Manufacturing is highly concentrated in metro Manila, more than half of the total of the Philippines.

Manila is the center of international trade for the Philippines, plus domestic trade between islands. Raw materials brought in from the interior of Luzon or from other islands is processed and exported, from sugar, rope, and cigarettes/cigars to shoes and woven textiles. The city struggles with air and water pollution. The government has designs to transform the former U.S. military bases into free-trade zones. The search for foreign investment in this project has found some success from Taiwan, but not enough, because of the economic downturn throughout Asia in the 1990s.

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## maps and globes

A MAP IS AN abstract representation of a selected set of features on or related to the surface of the Earth. The map reduces these selected Earth features to points, lines, and areas, using a number of visual resources such as size, shape, value, texture or pattern, color, orientation, and shape. Whereas aerial photographs and satellite images are realistic representations of the Earth, maps are an abstraction designed to focus and communicate specific information. The map is often drawn to scale, has a coordinate reference system to locate features, and is constructed on a flat medium such as paper or plastic film.

A globe, on the other hand, is a scaled representation of features on or related to the surface of the Earth and constructed on a three-dimensional surface such as a sphere. Globes are both objects of decoration and scientific value. Cartographers refer to a hypothetical “reference globe” as a scaled representation of the Earth that is then transformed point by point on a flat medium in an important process known as map projection. But globes are expensive to make, difficult to reproduce, inconvenient to store, and difficult to make measurements on. Maps created on a flat surface are not affected by these challenges.

### OLDEST MAPS

The oldest known maps are preserved on clay tablets from the Babylonian period (2300 B.C.E.). The Greeks also possessed advanced mapping knowledge and the concept of the spherical Earth was well known to Greek philosophers such as Aristotle (350 B.C.E.). During the 12th century onward, maps became influenced by religious views, exploration endeavors, and political ambitions and were highly valued for their economic and military uses. A significant benefit of historic maps is that they provide important clues about the social and cartographic traditions of past societies and civilizations.

Modern maps became increasingly accurate and factual from the 17th century onward. Developments in astronomy and cartography had provided a scien-

tific basis for preparing maps. An appreciation of maps and their uses begins with an understanding about how maps work. All maps are about spaces and places that are represented by shape, area, distance, direction, and location in a graphical medium. The surface of the Earth is not a flat plane, so a modification is required to transform the positions of places on the curved Earth to the flat sheet of the map so that distortions in shape, area, distance, direction, and location are minimized. This process is called map projection, and the transformation is governed by rigorous mathematical rules. The projection process takes the lines of latitude and longitude of the spherical Earth and arranges them on a flat plane as a uniform grid. These grids together with a scale that links the relative linear proportions of the spherical Earth and its representation on the flat plane allow the map space to be structured such that map properties can be determined to a high level of accuracy. Some examples of projections include the Mercator and Robinson projections.

### MAP SCALE

The map SCALE determines the level of detail the map can show. Maps of a large scale show more detail with greater accuracy. As the map scale becomes progressively smaller, larger swaths of geographic areas are shown and so features on the map must be generalized to avoid congestion. The generalization procedure involves stages of simplification, selection, enlargement, displacement, and merging. Simplification involves the progressive collapsing of map features from area to line to point representation as scale decreases. As an example, a lake may be represented as an area at one scale but as a point at a smaller scale. Selection attempts to retain features that are important given the goals and uses of the map. However, some of these important features might not be clearly visible at the desired scale and so enlargement artificially distorts their dimensions to enhance visibility. Displacement shifts overlapping features so that they become separate elements and more clearly identifiable. Merging aggregates multiple features into simpler ones to correct map overload that can arise from too much detail.

The mapping process also includes the symbolization of the real world using a standardized graphical language. The symbols used have dimensions—point, lines, areas, volumes, and duration—and can be distributed in a discrete, continuous or sequential manner to communicate feature patterns. Lettering and text labels also form an important part of the feature encoding process. Information about each feature, such as



type of road or population, is encoded using variations in nine graphic variables. The graphic variables are size, shape, orientation, color value, color intensity, level of grayness, texture, focus, and arrangement. It is these graphic variables together with strict rules for their use that allow the cartographer to encode and distinguish the diversity of features from the spherical real world into the flat map.

### MAP CATEGORIES

Generally, there are two categories of maps: topographic and thematic maps. The topographic map shows the outlines of selected natural and anthropogenic features, and is used mostly as a reference tool or as a base for integrating other types of existing or new information. The thematic map is used to communicate geographical notions such as population densities and land use. Thematic maps are especially important because they are used extensively in geographical information systems (GIS) as digital mapping outputs. Choropleth thematic maps use units such as counties or census tracts to display aggregate data about income and population for example. The area class thematic map shows units of constant attributes, such as vegetation. The isopleth thematic map shows an imaginary surface constructed by using lines to join points of equal value such as in a temperature and contour map.

Maps provide useful and concise spatial information in a meaningful manner and we use them directly or indirectly in many aspects of our daily lives. Navigating the roadways, finding new places, or simply reflecting on the aesthetics of the map are typical examples of how we use maps. Maps are also used for storing data, as a spatial index for labeling features or integrating multiple map sheets, and as a spatial data analysis tool for planning and decision making. A simple but powerful analysis tool is the map overlay process developed by Ian McHarg in which multiple map layers on transparent film are overlaid to identify regions of interest.

### GLOBES

The globe is a three-dimensional representation of the Earth and has an entirely different but familiar construction than a flat map. The globe is composed of longitude lines (meridians), which run north-south, and latitude lines (parallels), which run east-west. The longitude lines converge at the North Pole in the Northern Hemisphere, and at the South Pole in the Southern Hemisphere. The equator divides the Earth

into two hemispheres. All meridians and the equator are GREAT CIRCLES since they can form planes that cut the surface and pass through the center of the Earth. Small circles such as latitude lines form a plane that cuts the surface but does not pass through the center of the Earth. In this system of reference, geographic coordinates are measured in units of angular degrees. There are 360 degrees of longitude around the equator, with each meridian numbered from 0 to 180 degrees east and west such that the 180 degree meridian is on the opposite side of the Earth from Greenwich, England. There are 180 degrees of latitude from pole to pole, with the equator being 0 degrees and the north and south poles being 90 degrees. Each degree can be divided into 60 minutes and each minute is divided into 60 seconds. The north-south line is called the prime meridian, which has been set to pass through the Royal Observatory in Greenwich.

The longitude is measured as the angle between the point, the center of the earth and the prime meridian at the same latitude. West is positive and east is negative, meeting at 180 degrees at the international dateline. The east-west line follows the equator and is midway between the north and south poles. Degrees of latitude are measured as the angle between the point on the surface, the center of the earth, and a point on the equator at the same longitude. Here, the size of the cells is largest at the equator and the zones are square. At the poles the zones are smallest and mostly triangular.

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## market geography

MARKET GEOGRAPHY is a subfield of ECONOMIC GEOGRAPHY that focuses on the spatial nature of market forces. It derives its rationale from the central place theory, first argued in 1933 by German economic geog-

rapher Walter CHRISTALLER in his book on central places in southern Germany. Central place theory is fundamentally concerned with the patterns through which wholesale, retail, service, and administrative functions, plus market oriented manufacturing, are provided to consuming populations.

As such, it complements the theory of agriculture production originally formulated by J.H. von Thunen and the theory of location of industry, which has its roots in the work of Alfred Weber. The increasing dominance of market-based economic functions has established a clear linkage between the workings of market forces and spatial distribution of economic activities. Though location-market linkage is in the agriculture, manufacturing, trade, and transportation sectors, it's more pronounced in the sphere of production and finance.

### GEOGRAPHY OF MONEY AND FINANCE

Ron Martin (1999) claims the emergence of an economic geography of money and finance as a subdiscipline, with four identifiable lines of inquiry: 1) Marxist theorization of the geographically uneven and crisis-prone tendencies of the capitalist space economy; 2) specific studies of spatial organization and operation of particular financial institutions, services, and markets; 3) studies of dynamics through which the world's major financial centers are molding global geographies of money (such as LONDON, NEW YORK, and TOKYO); and 4) studies of services to link regional financial flows and regional industrial development. He demonstrates that financial systems are inherently spatial in terms of "location structure" and "institutional geographies" that influence the way money moves between locations and communities as well as "regulatory spaces" and the "public financial space of the state," including the cooperation and competition within the international monetary system. He notes that the money "has a habit to seeking out geographical discontinuities and gaps" to reinforce, rather than reduce, uneven regional pattern.

David J. Porteous (1995) offers a theoretical viewpoint that highlights the significance of "information externalities" and "an information hinterland" to account for urban agglomeration of financial activities. He also explains "spatial switching" as a reversal of the rank order of importance of rival financial centers within national economies, for example, Montreal/Toronto and Melbourne/Sydney. Gordon L. Clark (1993) stresses the importance of U.S. and British geography of pension funds and reveals why this source of

capital has such strong influence upon global economy. Clark and other scholars (1997) have attempted an analysis of the "spatial logic" of the financial industry.

David Harvey (1982) stresses the importance of time and geographical space to argue that contradiction in the primary or productive circuit of capital could be dampened down by foreign direct investment to secondary and tertiary circuits. These circuits export wider financial instability in new forms through the creation of fictitious credit money in advance of actual production and consumption—thereby producing the "system's instability." On this platform, Harvey identifies different types of crises, including "sectoral switching crises" (where fixed capital formation is switched to another sphere, such as education), "geographical switching crises" relating to different geographical scales, and "global crises." Harvey considers the further dimension of "GEOPOLITICS" at each scale to suggest that crisis tendencies are not resolved in an orderly manner but involve competitive struggles influenced by discriminatory institutional practices, circuits of money, and cost reduction according to financial, economic, political, and military power.

Stuart Corbridge (1993) suggests limitations of Keynesian measures of financial debt in the consideration of the geography of commercial bank lending in Latin America, the Caribbean, Eastern Europe, and the THIRD WORLD. Others have explored the "world of paper and money" with the following aims: to describe the economy of international money, to link this economy with the distribution of social power, to show some of the ways in which the world of money is discursively constituted through social-cultural practices, and to show how the world of money is constructed out of and through geography. Authors follow neo-Gramscian regulatory theory and operate within four spatial frames: the global monetary economy, the national space of Britain, the regional space of south of England, and the concentrated urban space of the city of London.

The book *Money/Space* is a critique of the rise and fall of "Thatcherism" and "Reaganomics," which marked unprecedented growth of the financial services industry, followed by the rise of disintermediation, a wave of financial innovation, and then more sophisticated forms of risk management. One chapter gives attention to "geographies of financial exclusion" in Britain and the UNITED STATES and suggests that "financial citizenship" is needed as a means of exerting pressure on governments to reform their financial system. The impact of changing geopolitics upon the circula-

tion of capital is enlarged by other scholars. Iain Black (1989) has reconstructed highly fluid spatial mobility of finance within a London-centered political economy during the INDUSTRIAL REVOLUTION and a more contemporary analysis of metropolitan London responses to the financial revolution of the 1980s.

Andrew Leyshon's (1997, 1998) analyses keep abreast of the growth of geographical treatments of money and finance. In one analysis, he links such contributions to the concept of a "geo-political economy," explores the "geo-economics of finance," and reflects upon wide unease over the geographies of financial exclusion. His other analysis draws upon Viviana Zelizer's theory of the social meaning of money, then reviews geographical analysis of the social and cultural construction of financial centers.

### GEOGRAPHY OF INDUSTRY

The heart of market geography lies in the spatial patterns and physical landscapes that industry creates. As spatial division of labor disperses industry, such as automobile manufacturing, into a thousand pieces—tire factory here, engine plants there, electronic ignitions and engineering plant somewhere else—it is increasingly difficult to knit together the production function into discrete units called factories. To make matter worse, these webs of production overlap and interconnect in surprising ways that can never be entirely untangled.

This immense geography of production is in constant motion, rendering moot all fixed ideas about industry location patterns. Industrialization drives sectors and places along divergent paths of growth, and disrupts all established geographic habits. That divergence and instability are essential to the uneven development of the industrialized world.

But the movement alone does not capture the creative (and destructive) powers of modern industry. Successive industrial revolutions have built up the great cities, transport systems, and landscapes of production that surround us; industry does not locate in a known world so much as it produces the places it inhabits. This jagged process of industrial development repeatedly outruns prediction and liquidates the geographies of the past; generating endless novelty that makes market geography such a lively and challenging subfield of inquiry.

As the world moves toward the more information-rich forms of production and products, like computer software and video games, there are more products that come in small packages, like CDs, and fewer bulky

objects like steel girders. But production is, in all cases, an act of human labor; it involves work, plain and simple. This means that securing a labor force is a prime task of any industrial operation and critical to its locational calculus. Firms must recruit labor either by locating near to where workers live or by attracting them from long distances; this matching of labor demand and supply is the base point for market geography. Different kinds of work demand different kinds of capacities from workers and provide varying levels of wages and other rewards, and here lies an elemental force for spatial differentiation of industrial activities or spatial divisions of labor.

### MARKET ECONOMIES

Today's market economies produce millions of different commodities for sale and employ hundreds of millions of people. They are immensely complex systems of production, made up of an extraordinarily large number of pieces. Those bits and pieces constitute "the division of labor" and are the basic building blocks of the industrial system and of market geography. Without the division of labor, there would be no differentiation of economic activities, no factories to site, and no localization of industries. The pied and dappled geography of modern economies comes about precisely because of the wide variety of work being done at different places.

Yet the division of labor is not infinite. Work today is mostly collective labor, where each person is responsible for a part of the whole. These collectivities range from small groups, such as fabric cutter, to whole garment factories, to entire commodity chains. A basic concept of the study of industrial geography is, therefore, a social division of labor.

The term *industrial location* was largely replaced by *spatial division of labor* in the lexicon of economic geographers during the 1980s. The former had come to mean the optimal siting of production units according to their specific needs for inputs, in the tradition of Alfred Weber, or the optimal spatial allocation of sellers according to a highly abstract calculus of access to customers, in Christaller's (1935) central place theory. Industry was assumed to conform to preexisting patterns of people and resources on land.

Doreen Massey (1984) turned this around. For her spatial division of labor signified a view of industrial pattern that recognized powerful forces for spatial differentiation coming out of industry itself and projected onto the landscape. The power of industry and market created a dominant force that effectively shaped the

spatial concerns and in the process created a market geography where market is a senior partner and geography became a junior partner.

A survey of literature in the subfield of market geography indicates that research since 1954 can be divided into three categories, on the basis of approach and methods: qualitative interpretation, usually with substantial numerical evidence and sometimes making use of case-study technique; quantitative classification, in a more or less descriptive sense, with qualitative elaboration and explanation and involving a specific procedure applicable to different areas and time periods; and formulation and testing of specific hypotheses and models. These approaches have been applied, with varying degrees of intensity, to most facets of market geography.

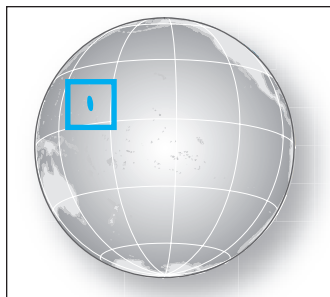
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## Marshall Islands

**Map Page** 1125 **Area** 70.7 square mi (181.3 square km)  
**Capital** Majuro **Population** 56,429 **Highest Point** 33 ft (10 m) **Lowest Point** 0 m  
**GDP per capita** \$1,600 **Primary Natural Resources** coconut products, marine products, seabed minerals.



THE REPUBLIC OF THE Marshall Islands, formerly a component of the United Nations Trust Territory of the Pacific Islands (administered by the UNITED STATES since the end of World War II), became an independent

state in free association with the United States in 1986. The island country consists of 29 atolls and five islands arranged in two parallel chains, known as Ratak ("sunrise") and Ralik ("sunset"), covering about 750,000 square mi (1,923,077) of open sea. The islands retain a strong U.S. military presence, strategically located halfway between HAWAII and AUSTRALIA, and remain the site of controversial missile testing ranges on a U.S. base at Kwajalein.

The Marshall Islands are the easternmost part of the former Trust Territory, with the Federated States of MICRONESIA (formerly the Caroline Islands) lying to the west and the former British colony of KIRIBATI immediately to the south. The U.S.-held island of Wake is about 500 mi (800 km) to the north, and Hawaii is located 2,300 mi (3,700 km) to the northeast.

Each of the major atolls, crowns of submerged mountains, consists of numerous small islets set in coral reefs surrounding irregularly shaped lagoons—the total number of these islets reaches about 1,150. Kwajalein Atoll has the world's largest lagoon, with 98 associated islets. But only a few of the islets are large enough to support settlements—most of the population lives on Majuro (Mājro), and the other major islands of Kwajalein (9,311), Jaluit (2,000), and Arno (1,000). Other atolls or islands with populations above 700 include Ebon, Enewetak, Mile, Namorik, and Namu. Residents of Bikini, Enewetak, and Rongelap were relocated to other islands in the 1950s after U.S. nuclear testing made the islands uninhabitable.

The climate is tropical, hot, and humid. The islands are formed of low coral limestone and sand, limiting agricultural output to coconut groves and small plots for melons, taro, and other tropical fruits. The economy is reliant on tourism and fishing, as well as craft items produced from shell, wood, and pearls. Revenue also comes in the form of U.S. financial assistance (\$102 million in 1998), both to the central government and to the victims of the nuclear testing of the 1950s, and the usual economic opportunities surrounding a U.S. military installation. The reefs are a major attraction, with several species of coral and five species of marine turtle known only in these islands.

The two chains were settled by Micronesians over 2,000 years ago, who named them Aelon Kein Ad ("our islands"). Encountered by Spanish explorers in 1529, the islands remained off the path of European expansion in the Pacific until they were "rediscovered" and named for the British captain William Marshall in the late 18th century. American whalers and missionaries competed with German entrepreneurs, who set up



the Jaluit Company in the 1870s as a trading post. Formally declared a German Protectorate in 1886, the islands did not remain under German administration, being occupied by the Japanese from 1914 until they were occupied by the United States in 1944. Nuclear testing began on Bikini in 1946, and the first hydrogen bomb was tested on Enewetak in 1952. The islands were self-governing starting in 1979, and the Compact for Free Association with the United States was finally approved and went into effect from 1986. The United States remains in charge of foreign affairs, and provides financial services and certain federal benefits.

Marshall islanders are not U.S. citizens, but are termed “habitual residents,” which allows them to enter the United States and work without visas or work permits. The Marshall Islands became a member state of the United Nations, but continue to be reliant on the United States (financial aid is about 55 percent of the national budget). The Free Association Compact was renewed in 2003.

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## Martinique

MARTINIQUE, IN the CARIBBEAN SEA, is one of the four French overseas departments and regions. Temperatures range from 25 to 30 degrees C (76 to 86 degrees F) and the climate is tropical and humid. The dry season runs from December to May (*carême*). Drought is relatively common from February to April. During the rainy season (*hivernage*), June to November, temperatures generally rise. Martinique's climate is tempered by trade winds but cyclones or hurricanes can be quite frequent.

The highest point in Martinique is Mount Pelée in the north, a live volcano that last erupted in 1902 and destroyed St. Pierre, which then was a busy port town: 30,000 were killed in the eruption. Mount Pelée is

today under constant surveillance. The north is mountainous and precipitation is high. Low hills (*mornes*) characterize the rest of the island, except for the flat Lamentin area on the west coast where the airport is situated.

Christopher Columbus discovered Martinique in 1502. The island was colonized by the French in 1635 and in spite of spells of British occupation in 1762 and during the Napoleonic Wars (1794–1802), the island remained a French possession. The bulk of today's black and mulatto population is descended from the slaves imported into Martinique to labor on the sugar plantations. East Indians and some Chinese and Lebanese also contribute to the diversity of the population. Slavery was abolished in 1848 and the colony became a French department in 1946 after a campaign led by one of Martinique's most well-known figures, Aimé Césaire. The island became a region in 1982. As such, Martinique is a member of the EUROPEAN UNION. The official language is French, but French Creole is spoken by the mainly black and métis population. Most Martinicans are Roman Catholics.

Martinique enjoys the same advantages as any other mainland French department or region in terms of health, education, and social welfare. The islands also benefit from special measures aimed at encouraging economic development (lower income tax for example). Martinique has a General Council (Conseil Général) and a Regional Council (Conseil Régional). The General Council has 45 elected members, one from each constituency, and the Regional Council has 41 members. Both councils elect their respective presidents. The Martinicans elect three deputies to the French National Assembly and two senators to the French Senate.

The president of FRANCE appoints a prefect (*préfet*), who then becomes the official representative of the French government in Martinique. The prefect is responsible for public order and safety and ensures that civil liberties are properly respected, but he/she does not exercise executive power, which is in the hands of the two councils. The principal export is fruit (mainly bananas). Sugarcane is grown on the island; rum is a derivative and distilled on site. The islands are also popular holiday destinations for the French and tourism represents 7 percent of the gross domestic product.

Nevertheless, government subsidies are essential to Martinique's economic survival. The island imports far more (mainly from France) than it exports (mainly to France). Unemployment is high; in 2002 one in four

persons was out of work compared to approximately one in 10 in metropolitan France.

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## Maryland

“THE OLD LINE STATE,” covering an area of 12,407 square mi (32,134 square km) is located in the mid-Atlantic UNITED STATES and features a diverse geography, prompting the nickname “a miniature America.” Maryland is one of the more irregularly shaped states, with a long straight northern border and an irregular southern border that is delineated by 285 mi (459 km) of the Potomac River. At its most narrow point, Maryland is only a scant few miles from its northern border to its southern border; at its widest point it is about 124 mi (200 km) from northern to southern border. Along the northern border, the state is bounded by PENNSYLVANIA for 190 mi (320 km), and on the western border is WEST VIRGINIA. On the south, Maryland is bordered by West Virginia at the far western reaches of the state and by VIRGINIA. Over the years, border disputes have occurred with Virginia, West Virginia, and Pennsylvania.

The nation’s capital, Washington, D.C., is located between Virginia and Maryland about 39 mi (63 km) southwest of the largest city in Maryland, Baltimore. The easternmost portion of Maryland is split into two by the Chesapeake Bay. This part of the state shares what is known as the DELMARVA PENINSULA with DELAWARE to the east and Virginia to the south. The highest point in the state is Backbone Mountain, located in the western reaches, 3,360 ft (1,024 m) above sea level.

The easternmost section of the state is a coastal plain at or about sea level and has considerable wetlands and marshes, especially along the Chesapeake Bay. The central part of the state, known as the Piedmont Plateau, is more hilly, while the westernmost part of Maryland is mountainous, containing a part of the Allegheny Mountains. Farming was historically prevalent in the central part of the state, while coal mining

was done in the mountains of the west. The Piedmont area is also known for its racehorse breeding. The southernmost area of Maryland has for hundreds of years been known for its tobacco farming, though this is now in serious decline. Forests are prevalent in western Maryland, with oak, pine and hickory trees. On the coastal plain, cypress and gum trees are common.

The chief city of western Maryland is Cumberland, and Hagerstown is the largest city in central Maryland. Baltimore, the most populous city in the state, is located on the Chesapeake Bay, while the capital, Annapolis, a much smaller city, is located 30 mi (48 km) south of Baltimore, also on the bay. The major tourist attractions are Baltimore, which has revitalized its historic waterfront. This city, the birthplace of Babe Ruth, has a notable maritime museum and is home to the USS *Constitution*, an 18th-century naval warship. On the Atlantic side of the DELMARVA PENINSULA, Ocean City is a popular vacation destination for beachgoers. The forested mountains of the west are a popular destination, and the historic town of Harpers Ferry, West Virginia, is just a couple of minutes from Maryland’s border. The northern suburbs of Washington, D.C., are in Maryland, including the populous Silver Spring. Many of these neighborhoods are connected to the nation’s capital by the subway system, known as the Washington Metro. Camp David, the presidential retreat, is also in Maryland.

Maryland’s roots go back to the early 17th century, when Captain John Smith mapped the area in 1608. The king of England granted Cecil Calvert, the Lord of Baltimore, a land patent in 1632. The first ships bearing European settlers arrived in 1634. They founded what is now St. Mary’s City on the bay. A border dispute between the colonies of Pennsylvania and Maryland resulted in two surveyors, Mason and Dixon, being called upon in the 1760s to chart the exact border. Their Mason-Dixon line has since been the unofficial line between north and south. Annapolis was the nation’s capital for a few years beginning in 1783. Maryland was in the midst of events during the War of 1812, when the British laid siege upon Washington, D.C. Francis Scott Key wrote the poem that became the national anthem, “The Star Spangled Banner,” in 1814 while watching the British bombardment of Fort McHenry in Baltimore Harbor.

Development of the state continued to be rapid. The first railroad in the country was begun in Maryland in the 1820s. In the Civil War, Maryland sided with the north, but thousands of its citizens joined the Confederate Army, believing their tobacco plantations

were at risk if slaves were freed. The bloody Battle of Antietam was fought in Maryland in 1862, resulting in more than 20,000 deaths. Nineteenth-century Baltimore was a major destination for immigrant ships from Europe.

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## Massachusetts

THE COMMONWEALTH of Massachusetts has a population of 6,379,304 (2001), more than half of whom live in the greater Boston metropolitan area. The largest city in the state is Boston (the capital), with a population of 589,141, and the smallest town is Gosnold, with a population of 86. It borders NEW HAMPSHIRE and VERMONT to the north, NEW YORK to the west, and CONNECTICUT and RHODE ISLAND to the south. Massachusetts has an area of 10,555 square mi (27,337 square km) and its highest point is Mount Greylock, at 3,487 ft (1,062 m). The lowest point is sea level or 0 ft.

Massachusetts has a widely varying topography, containing beaches, rocky shores and salt marshes along the coast and rolling and wooded hills throughout the central and western parts of the state. The state itself can be divided into six separate land regions: the coastal lowland, the Eastern New England Upland, the Connecticut Valley Lowland, the Western New England Upland, the Berkshire Valley, and the Taconic Mountains.

The coastal lowlands comprise the coastal lands along the ATLANTIC OCEAN, including low hills, swamp land, shallow rivers, and small ponds. Massachusetts also contains several islands, including the two relatively large islands of Nantucket and Martha's Vineyard, as well as the small group of Elizabeth Islands lying between Buzzards Bay and Vineyard Sound. (Boston Harbor itself, part of the Eastern New England Upland, is also home to a handful of small islands, some of which hosted prisoners during the Civil War, and others of which have been used at times for fortifi-

cation of the city). The Eastern New England Upland contains over half of the state's population, and spreads between the northern border with New Hampshire down to the state's southernmost border with Connecticut and Rhode Island. The state's most fertile region, however, is the Connecticut Valley Lowland, containing most of the state's farmland, lying between the Eastern and Western New England Upland. The only mountainous region is the Taconic Mountains, lying in the far western section of the state, where a narrow swath of mountains is found in the northwest corner.

The original inhabitants of Massachusetts were Native American tribes, including the Nauset and Wampanoag Algonquin Indian tribes settled along the coastal section of Massachusetts. European settlement and colonization of Massachusetts began with the arrival of the *Mayflower* in 1620. Europeans established a colony in Plymouth and several smaller fishing villages, including present-day Weymouth, Quincy, and Cape Ann. By 1630, the first large-scale Puritan migration from England occurred, with boats transporting approximately 900 settlers to Boston. In its initial incarnation, the Massachusetts Bay Company was governed as a private company for the first nearly half-century of its existence. The Puritans exerted a tremendous influence over the early development of the commonwealth, with many of their religious and educational influences lasting today. They established Boston Latin School in 1635 and, in the following year, Harvard University, founded with a grant from the General Court of the Massachusetts Bay Colony, both established with the idea of generating well-educated Puritan ministers. During this same time, Boston Common became the first public park in America. The period of 1684 to 1694, however, was a time of upheaval, with the Bay Colony's charter revoked, and the political and religious unrest playing out in dramatic fashion in the Salem witchcraft trials of 1692.

Massachusetts bore witness to a number of key events during the Revolutionary War, including the Boston Massacre (occurring in 1770 at the intersection of what is now State Street and Devonshire Street) and the Boston Tea Party. The famous April 19, 1775, ride of Paul Revere and the firing of the "shot heard round the world" culminated in the Battles of Lexington and Concord, both located only a few miles outside of Boston. In 1780, following the Battle of Bunker Hill and the British evacuation of the commonwealth, the Massachusetts Constitution was ratified, making it the oldest written constitution currently at use anywhere in





*Faneuil Hall and Quincy Market in Boston date back to the city's colonial days as a commercial hub, and remain so today.*

the world, according to the secretary of the commonwealth's Citizen Information Service.

Massachusetts has again played a significant role in national politics, beginning with the election of former Massachusetts Governor Calvin Coolidge to the presidency in 1923. Former Massachusetts Senator John F. Kennedy followed in his footsteps, winning the 1960 presidential election; 1988 saw Michael Dukakis, another former Massachusetts governor, run unsuccessfully for president against George H.W. Bush. In 2004, another Massachusetts senator, John Kerry, again unsuccessfully sought the presidency.

Massachusetts has also given birth to a number of notable individuals who have had a notable impact on the country in more than the pure political arena. These include not only such historical revolutionaries

as Samuel Adams, Benjamin Franklin, Paul Revere, Eli Whitney and Alexander Graham Bell, but intellectuals and writers, including Jack Kerouac, Edgar Allan Poe, Sylvia Plath, Emily Dickinson and Dr. Seuss (Theodore Geisel), as well as Jay Leno, Leonard Nimoy, Conan O'Brien, and Ben Affleck.

Massachusetts is well-known for being an intellectual and cultural hub, home to over 100 colleges and universities, including some of the more well-known: Harvard University (in Cambridge), Amherst College (in Williamstown), Boston College (in Chestnut Hill), Brandeis University (Waltham), Smith College (Northampton), and Wellesley College (Wellesley), to name but a few. The intellectual history of Massachusetts and the influence some of its more prominent citizens throughout American history have contributed to the political and liberal development of the entire United States.

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## Mauritania

**Map Page** 1113 **Area** 397,955 square mi (1,030,700 square km) **Population** 2,912,584 **Capital** Nouakchott **Highest Point** 2,985 ft (910 m) **Lowest Point** 0 m **GDP per capita** \$377 **Primary Natural Resources** fish, iron ore, gypsum, copper, phosphates, salt.



**MAURITANIA IS LOCATED** in Northwest Africa on the coast of the ATLANTIC OCEAN. It covers an area slightly larger than TEXAS and NEW MEXICO combined. It is bordered on the northwest and north by WESTERN SAHARA, on the northeast by ALGERIA, on the east and southeast by MALI, on the southwest by SENEGAL, and on the west by the Atlantic Ocean. Mauritania has 435 mi (700 km) of ocean coastline, which is extremely rugged with no natural harbors and has waves of ex-



traordinary height. The Senegal River forms the border with Senegal, helps to form an alluvial fan that supports agriculture in the area, and is Mauritania's most densely populated region.

Two-thirds of Mauritania is covered with DESERT. The country lies entirely within the SAHARA DESERT which covers an area of 3,320,450 square mi (8,600,000 square km). The 17th parallel is the dividing line between the true desert to the north and the Sahelian zone made up mostly of savanna to the south. The desert has no vegetation in the eastern parts of Mauritania, but the western section closer to the Atlantic has some temporary pasturage for nomadic camel herders. This western section also has some oases, the largest being the town of Atar. The desert is dominated by wind, sand, and erosion. It has many shifting dunes in immense basins that are grouped into "ranges." The only real elevation is an almost horizontal sandstone plateau rising 1,500 ft (460 m) that runs through the center of the country from north to south. There are also occasional buttes and steep rims covered in sand or sometimes pebbles.

The TROPIC OF CANCER crosses the northern half of the desert in Mauritania. In this area, there is a prevailing continental wind blowing year-round. Rainfall in this area amounts to less than 4 in (10 cm) per year, and when it does occur, rain is usually extremely violent and brief. To the south, in the Senegal valley, the area receives about 26 in (66 cm) of rain per year, mainly during the three or four months of summer. The temperature averages about 100 degrees F (37.8 degrees C) during the day in most of Mauritania and much cooler at night, sometimes down to near 32 degrees F (0 degrees C).

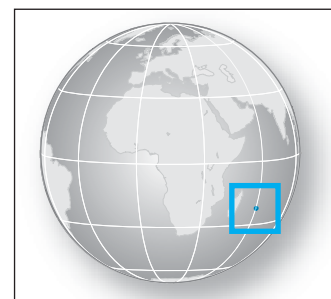
Mauritania gained its independence from FRANCE on November 28, 1960, and since then has been a constitutional republic. Soon after independence, Mauritania developed a modern mining industry. Miners found large deposits of high-grade iron ore in northern Mauritania and have since developed them for exporting. They also mine copper and salt in Mauritania. Most of the population, however, is busy raising crops or tending livestock in southern Mauritania. The ethnic groups that live in this area are mainly the Tukulor, Soninke, Bambara, and Wolof. The nomadic and seminomadic tribes of the Berber, Arab, Tuareg, and Fulani make up the majority of the population and range about Mauritania following their herds.

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## Mauritius

**Map Page** 1116 **Area** 788 square mi (2,040 square km)  
**Population** 1,210,447 **Capital** Port Louis **Highest Point** 2,732 ft (828 m) **Lowest Point** 0 m **GDP per capita** \$11,000 **Primary Natural Resources** arable land, sugarcane, tea, cattle, goats, fish.



MAURITIUS IS AN island nation in the INDIAN OCEAN, located about 500 mi (800 km) east of MADAGASCAR. Governed by successions of Dutch, French, and British colonial administrations, and settled with workers from East Africa, INDIA, and CHINA, Mauritius today is an interesting hodgepodge of these various elements in everything from language to culture to politics. More economically and politically stable than some of its island neighbors, with one of the highest per capita incomes in the developing world, it is a leader in the Indian Ocean Rim Association, and maintains strong ties with several east African, Arab, and Far Eastern nations.

The country of Mauritius includes the main island, plus Rodrigues Island (372 mi or 600 km to the east) and the much smaller (and much farther away) Agalega Islands and Cargados Carajos Shoals to the north. Together with the island of Réunion (an overseas department of FRANCE), Mauritius and Rodrigues are collectively called the Mascarene Islands. The islands to the north are very small and unpopulated, but they form a key part of Mauritius's claims to an EEZ (exclusive economic zone) covering 468,000 square mi (1.2 million square km) of the Indian Ocean off the coast of Africa.

There are tensions over claims put forward over Tromelin Island to the northwest (held by France) and Diego Garcia far to the northeast (1,197 mi or 1,931

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km) in the Chagos Archipelago (held by the UNITED KINGDOM).

The islands are in an area of geologic activity. The Mid-Indian Ocean Ridge lies 200 mi (320 km) to the east, with the Rodrigues fracture zone and the Mauritius Trench as perpendicular offshoots. Mauritius is of relatively recent volcanic origin, about 12 million years, but has been dormant for the last 100,000 years. It is formed of a ring of mountains (about 18 percent of the land area) encircling a central plateau with a smaller coastal plain. Rodrigues is of similar volcanic formation, but in a ridge running west to east, and much younger (about 1.5 million years). Both are ringed by coral reefs. The smaller islands are not volcanic, but coralline, and are home to coconut palms and fishing boats.

The islands' tropical climate and position along southeast trade winds attracted Arab and Malay traders, followed by Portuguese explorers, who named the main island Ilha do Cirne ("island of the swan") early in the 16th century—possibly for the native population of large flightless birds called dodos. The Dutch attempted settlements and plantations twice in the 17th century. Neither attempt took root, but the island's new name did—Mauritius, named for Maurits van Nassau of Holland—as did their environmental impact, that is, the extinction of the dodo, the introduction of rats, and the replacement of much of the native ebony forests with sugarcane. The French East India Company claimed the island in 1715, having already begun settlements on Rodrigues and Bourbon (today's Réunion). Port-Louis was an important center for trade, privateering, and naval operations against the British, and French planters grew very rich on the backs of African slave labor.

The British took the islands in 1810 and retained the colony after the 1814 settlements ended the Napoleonic Wars back in Europe, but most of the French sugar planters stayed on. The small number of English settlers meant that Mauritius retained much of its French culture, and many people today speak a French patois (mixture). With the abolition of slavery in 1834, the British imported indentured workers from India in vast numbers; they made up about two-thirds of the population by 1870.

Today, the descendants of South Asians continue to outnumber the descendants of freed African slaves (Creoles) and the small numbers of people of Chinese and European origin. Tensions between these groups have largely been settled since independence from the United Kingdom in 1968.

The economy was almost entirely sugar-based until recently, but is now being diversified into production of textiles, chemicals, and other light industry, plus the encouragement of tourism. It remains a member of the Commonwealth, but became a republic in 1992. Population density on Mauritius is one of the highest in the world, while only 36,000 people live on Rodrigues.

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## McKinley, Mount

MOUNT MCKINLEY is the highest peak in North America with a summit at 20,329 ft (6,196 m). Located in the 600-mi- (965-km-) long Alaskan Mountain Range, it is approximately 150 mi (246 km) south of Fairbanks, ALASKA. Mount McKinley is home to more than 650 species of flowering plants, as well as mosses, lichens, fungi, and algae. The growing season is short, and only plants that have adapted to the region's cold winters can survive.

Mount McKinley is located near the center of the 6-million-acre Denali National Park and Wildlife Preserve. The terrain was carved by glacial activity approximately 10,000 to 14,000 years ago. Mount McKinley, or Denali, consists of two peaks that are permanently covered in snow. It is located by a major fault system, known as the Denali Fault, which makes it subject to continual tectonic uplift. A major earthquake in 1912 caused a significant segment of the south face of the mountain to shear off. Many smaller earthquakes occur each year, although they are generally unnoticed. Denali is surrounded by the rugged peaks of other members of the Alaska Range as well as open tundra, glacial rivers, and flood plains. The region is home to a diverse range of wildlife, including 167 species of birds, 10 species of fish, 39 species of mammals, and 1 species of amphibian.

Denali's climate is subarctic. Summers are short, dry, and generally cool. Cloud cover obscures the mountain's peaks much of the time. Winters usually bring heavy snows and extreme cold. The road system through the park is closed in the winter months. The

rangers who are responsible for overseeing the protection and maintenance of the park often use dog sleds, going out on patrols of two or more weeks.

Mount McKinley was originally named Denali (“great white one,” or “high one”) by the Athapaskan natives, who lived and hunted around the mountain. McKinley was renamed in 1896 by William Dickey. Dickey, a Princeton University graduate who was performing a survey of the mountain following a prospecting trip, renamed it after presidential candidate William McKinley. Although Dickey claimed discovery of McKinley, the first sighting by a nonnative was actually nearly 150 years earlier by Vitus Bering in 1741.

Denali, as it is now called by the Alaskans, has a rich history of exploration. Unpredictable weather and rugged terrain, including swamp and crevasse-laden glaciers, that surround the mountain make climbing it a challenging and dangerous venture.

The first attempt to scale the mountain, which proved unsuccessful, was made around 1900 by Judge James Wickersham. Frederick Cook claimed to have reached its summit in 1907, but his claims were proven untrue three years later. The first successful scaling of the North Peak was accomplished by the so-called Sourdough Expedition Party in 1909. The South Peak was conquered by the Hudson Stock expedition four years later, in 1913.

The introduction of air travel drastically improved access to the region for exploration and surveying. Most of the region’s bush pilots, including the legendary pilot-explorer Don Sheldon, fly out of the small town of Talkeetna, which is approximately 121 km (75 mi) south of Denali.

In 1936 and 1937, noted explorer-photographer Brad Washburn embarked on the first of many expeditions to climb and photograph Denali and the surrounding region. Washburn, whose expeditions were later joined by his wife, Barbara, provided an unparalleled glimpse of the mountains for those outside of the exploration community. Hundreds of books on Denali and the region have been produced that utilize Washburn’s photographs.

Because of the extremity of McKinley’s terrain, the mountain and its surrounding regions were a popular site for the development of search-and-rescue procedures by the U.S. Army’s Tenth Mountaineering Core in the middle of the 20th century. Search-and-rescue remains an important part of life in the area. In 1980, under pressure from Alaskans, the UNITED STATES passed a bill to rename the mountain and its surrounding lands the Denali National Park and Preserve. The

park is currently administered as a wildlife preserve by the U.S. National Park Service, which is a part of the U.S. Department of the Interior. In the mid-2000s, there have been pressures from the American political right to commence drilling for oil within the boundaries of the preserve.

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## Mediterranean Sea

THE TRANSLATION of its Latin name (“in the midst of land”) indicates that the Mediterranean Sea is located between the landmasses of Europe, Asia, and Africa. Some students of geography may view the Mediterranean as a physical separation between Europe and Africa. Nothing could be further from the truth. The Mediterranean, in fact, has been the great unifier and link for cultures from Africa, the MIDDLE EAST, and Europe as well as Central Asia (via the BLACK SEA passage). Its moderate climate and rich land and sea resources have made the Mediterranean Basin and Sea an historic storehouse of foods as well as a means of commerce. Perhaps a better image is one of a giant mixing bowl that collects and spins out various cultures and economies. Even geologically, the Mediterranean Sea is where the African and European plates meet, their friction creating the rich marble quarries and volcanoes that mark much of ITALY and the Sea of Marmara (marble) in TURKEY.

The sea’s total surface area is 967,000 square mi (2.5 million square km). Acting as a major heatsink, it is an important climate modifier (its latitude is the same as that of the much colder areas of Manchuria and north CHINA). It is approximately 2,400 mi (3,900 km) long, with a maximum width of 1,000 mi (1,600 km), and while relatively shallow at GIBRALTAR and the Dardanelles, it is over 16,000 ft (5,400 m) deep near Cape Matapan, GREECE. Its waters have a higher salin-



*The Mediterranean Sea has for millennia been the great unifier and link for the dozens of countries and cultures from Africa, the Middle East, and Europe as well as Central Asia (via the Black Sea passage).*

ity than the ATLANTIC OCEAN in part because there is so little tidal movement. It also has very few rivers that add fresh water, and its high sunshine creates massive rates and volumes of evaporation. Its rich marine resources include over 400 varieties of fish, along with sponges and corals and recently, oil and natural gas also have been found in several sections. Combined with large and often poor populations, there is much overfishing and pollution. But its mild climate has also created rich agricultural resources, and its geology has added important minerals—especially tin and copper so important to the Bronze Age.

Because of its size and complexity, the Mediterranean can be considered a combination of basins or “seas,” and not as a monolithic whole. For example, in addition to the shallow sills at Gibraltar and the Dardanelles, there is a shallow sill (the Adventure Bank) between Sicily and TUNISIA that clearly divides the Mediterranean into two primary basins: east and west. In addition, history and geography have created a number of distinct local “seas” essential to understanding the basin’s history. These include the Ligurian Sea north of Corsica; the Tyrrhenian Sea enclosed by Sar-

dinia, Italy, and Sicily; the ADRIATIC, which separates Italy and the Dalmatian coast of the former Yugoslavia, the Ionian Sea between Italy and Greece, the AEGEAN between Greece and TURKEY, and the Thracian Sea to the north. And this omits the various seas associated with the Black Sea.

Today, the Mediterranean forms a maritime link for 23 countries (more if we count the countries that share the coast of the Black Sea), including: SPAIN, FRANCE, MONACO, Italy, MOROCCO, ALGERIA, TUNISIA, LIBYA, EGYPT, SLOVENIA, CROATIA, BOSNIA AND HERZEGOVINA, ALBANIA, Greece, Turkey, MALTA, CYPRUS, SYRIA, LEBANON, and ISRAEL. It provides for maritime passage from the heart of RUSSIA and Central Asia via the Black Sea, to the New World via the ATLANTIC OCEAN, and to the INDIAN OCEAN and Pacific Far East via the Suez Canal. Its rivers create land links that tie it to northern Europe as well as to eastern Africa and the Indian Ocean.

The populations with direct access to its shores exceed 425 million (650 million including countries bordering the Black Sea). This makes the Mediterranean Basin potentially one of the world’s major economic



zones. It also makes it a focus for political intrigue from Asia and the Middle East to northern and eastern Europe.

In addition to its rich resources and history, it is the sea's strategic geopolitical characteristics—past, present, future—that have dominated its existence. The strategic maritime CHOKE POINTS and history of GIBRALTAR, MALTA, Taormina, and the Dardenelles and Bosphorus provide countless examples of the geography behind history.

And the mixing of cultures also has made the Mediterranean Basin a historic center for unique and rich art traditions, from the ancient cave paintings of France and Spain, to the work of modern artists like Marc Chagall, Pablo Picasso, and Paul Cezanne to the mosaics and unique architecture of the Byzantines and Italians. There are naval arts and maps associated with the rise of maritime powers such as the Ottomans, the Venetians, the Genovese, the Spanish, and more.

The LITTORAL (coast) of the Mediterranean was the focus of the Phoenician, Greek, Minoan, Egyptian, Syrian, Macedonian, Roman, Venetian, Genoan and other city-states, empires, and civilizations. Trade, navies, and armies moved over its surface and along the passes to and from its shores.

The shallow and narrow passage linking the Mediterranean to the Atlantic at Gibraltar is only 8 mi (12.9 km) wide, but strong winds and extremely strong tidal flows and currents often forced ancient people to find land routes around the barrier. Similarly, the strong currents over the shallow and narrow sill linking the Mediterranean and Black Seas at the Dardanelles (1 mi or 1.6 km wide) long halted direct shipping between the two basins and was the focus of such epic battles as that of Troy in ancient times and Gallipoli in more modern times.

The Mediterranean is also a center of land trade, both along the shores and at various key land passages, because of its rivers and valleys that link it with the people and resources of northern Europe.

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## megaliths

A GREEK-DERIVED word meaning "large stone," *megaliths* refer to huge, uncut, or roughly cut boulders that people have moved to stand upright from the ground. Some megaliths, also called menhirs, have been in place for thousands of years, and the reasons for their positions are not fully known. They are found all over the world.

The most famous megaliths are at Stonehenge, a United Nations World Heritage Site of about 100 acres on the Salisbury Plain in England, UNITED KINGDOM. Stonehenge's construction began around 3150 B.C.E., predating most known cultures of Britain. Simply transporting the stones, which weigh as much as 50 tons (45.3 metric tons), from quarries 17 mi (27 km) and 150 mi (241 km) away, then erecting them on sloping ground in careful circles, involved incredible feats of engineering. The stones are positioned to align with sunrise on the summer solstice, indicating knowledge of astronomy. The organization involved in such an undertaking implies a powerful social administration as well.

Other stone circles have been found in the British Isles and elsewhere. One recently discovered circle dating to 4500 B.C.E., is in Nabta Playa, SUDAN. Research indicates it served as a calendar. The study of archaeoastronomy, started in the 1960s, links many megalithic circles and groups to alignment with astronomical events, such as solstices, eclipses, and the 18.5-year metronomic cycle of the moon's transit.

In addition to circles, megaliths are found in multiple rows. The stones at Carnac, near Morbihan Bay in Brittany, FRANCE, are famous examples of these. Most date from Europe's Iron Age. Megaliths may also be arranged in long avenues, pairs, single rows, triads with a taller center stone, and many other formations. At Callenish on the Isle of Lewis in Scotland, pairs of stones form an avenue that leads to a stone circle surrounding a tomb, with three short rows emanating from it. In 1993, Aubrey Burl catalogued hundreds of megalithic pairs and groupings in Britain, Ireland, and Brittany in his book, *From Carnac to Callenish*.

Some megaliths are formed as dolmens: the large upright stones form a room, with a stone on top as a roof or capstone. These are also called cromlechs, although the term is not used consistently. Dolmens and chamber tombs have been found above- and below-ground in the British Isles, France, SPAIN, ITALY, MALTA, Scandinavia, ETHIOPIA, JORDAN, southern INDIA, CHINA, the KOREAS, JAPAN, and COLOMBIA. In some instances,

rough impressions have been carved on the stones. Stones have also been toppled, moved, and reused, and recarved throughout the years.

Standing stones, in any formation or alone, are located all over the world. Granite stones stand in YEMEN, near artifacts dating from 2400 to 1800 B.C.E. In the CAUCASUS MOUNTAINS of RUSSIA, hundreds of dolmens and standing stones, some carved in bas-relief, served as burial chambers. Rows leading to semi-circles of stones have been described in Tibet. Even in the New England states of the UNITED STATES, megaliths have been found standing alone or in groups; the undated complex at Mystery Hill in MASSACHUSETTS is called America's Stonehenge.

Not all megaliths were raised in the distant past. Recently constructed megaliths exist in the Sarawak area of BORNEO, scattered over the foothills near Mount Kinabalu. They were moved and erected in living memory, according to residents, as memorials, sometimes for the dead, and to affirm status or land claims. In MADAGASCAR, megaliths were raised into the 19th century as ancestral tombs.

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## Mekong River

THE MEKONG IS the 12th-longest river in the world, traveling nearly 2,600 mi (4,200 km) from its source in the Tibetan plateau to its enormous DELTA in southern VIETNAM. It is the major transportation highway and supplier of life for most of Southeast Asia—with five cities over 100,000 and one-third of the populations of THAILAND, LAOS, CAMBODIA, and Vietnam (60 million people) in the lower Mekong basin—yet much of it is still undeveloped (the first bridge was built in 1993, between Thailand and Laos) and even unexplored (the source was located definitively only in 1994). This is

due to the torturous path the Mekong cuts through rough mountain terrain on its journey from the Tanggula Mountains in CHINA to the SOUTH CHINA SEA. It changes names many times along the way, from Lancang Jiang ("turbulent river") in China, to Mae Khong ("mother of waters") in Laos and Thailand, Tonle Thom ("great water") in Cambodia, and Tien Giang or Cuu Long ("river of nine dragons," for the delta's many channels) in Vietnam.

The river is navigable by seagoing vessels as far as Phnom Penh, the capital of Cambodia, a distance of 340 mi (550 km), but they are prevented from going much further upstream by numerous sandbanks and rapids. Communities upriver use smaller vessels on the river, in some places the only route for communications and transport of goods. European powers were excited by the possibility of using the Mekong as a passage to the riches of the interior of China, which never materialized.

The French established a protectorate over the kingdom of Laos in the 1860s (in haste, to beat the British) before fully exploring this option, however, and were disappointed by the river's limited capability for commercial transport in the interior. Laos was therefore mostly ignored as a colony (benign neglect), and remains one of the most underdeveloped nations in the world. The 1990s witnessed a burst of hydroelectric projects (23 are planned in Laos alone), generating a good deal of international protests, because of the enormous impact these projects will have on the ecology of the region and the lives of millions of its inhabitants. The Mekong River Commission, based in Phnom Penh, predicts dire consequences for rice production and the fishing industry in the lower basin, which accounts for about 2 percent of the world's total. Manwan Dam in Yunnan Province (China), for example, will radically alter the course of the river, preventing downriver annual flooding essential to the production of rice. Regional governments ignore these warnings, however, seeing the projects as major symbols of their countries' modernity.

The Mekong originates near the roof of the world, in the Jifu Mountains (about 17,160 ft or 5,200 m), near the town of Zadoi on the borders between the Chinese provinces of Xizang (Tibet) and Qinghai. Here the small mountain river moves swiftly through barren chasms and gorges. The river flows south into Yunnan province through narrow gorges, only a few kilometers from the parallel valleys of the upper Salween and Yangzi (CHANGJIANG) rivers, which ultimately end their courses thousands of kilometers away in the BAY OF

BENGAL and the East China Sea, respectively. The river then flows from China into the valley separating eastern MYANMAR from Laos, which has served as a conduit for Chinese migration into Southeast Asia. Thousands of Chinese emigrated to Mandalay in Myanmar, where they now dominate commercial life. This route is also a passage for illegal arms shipments from China and for drugs (opium and heroin) into China.

The Mekong then forms the main corridor of settlement for the lowland Lao peoples, first in the interior of the country, then along its border with Thailand. One of the oldest cities in the region, Loang Prabang, was established on its banks in the 14th century, followed by a rival Buddhist kingdom centered at Vientiane (Viangchan), about 250 mi (400 km) downriver. Loang Prabang retains much of its beautiful architecture, Buddhist temples, and French colonial buildings and has recently been classified as a World Heritage Site.

Below Pakxé (Laos), the Mekong becomes much wider, and, after the dramatic drop at Khone Falls on the border with Cambodia, enters the wide, flat Cambodian plain. Thousands of years ago, this plain was at the bottom of the sea, but material brought downstream from the mountains gradually filled it in to form a fertile plain, with numerous confluent rivers and large lakes. The largest of these lakes, Tonle Sap, is the remaining evidence of the sea's onetime incursion into this area. The lake is formed by one of the rivers that flow into the Mekong, which reverses course from backflow during the rainy season, expanding the lake up to six times its normal size. This area, with its natural irrigation systems and fertile soils, was home to many early civilizations in Southeast Asia, including the empire of the Khmers with its famous temples at Angkor Wat.

The Mekong delta starts in Cambodia and extends 175 mi (282 km) to the sea. Forming a vast alluvial plain (called the Plain of Reeds), it is the heartland of southern Vietnam, covering 26,000 square mi (67,340 square km). The river splits into two main channels, and numerous smaller passages, forming a broad delta on the South China Sea.

The delta was the site of many powerful civilizations, notably the Cambodian kingdom of Funan, which was a busy ENTREPOT between Chinese and Indian civilizations as early as the 3d century C.E. (even Roman coins have been discovered here). Commercial wet-rice production was established by the French colonial powers from the middle of the 19th century. It

was the economic center of the former South Vietnam, and remains one of the most densely populated areas in Southeast Asia.

As independent nations, the countries bordering the Mekong River have struggled to coordinate activities and to limit destructive overdevelopment in the production of rice and logging. Since 1957, regional associations have proposed numerous projects for hydroelectric power, navigation, and flood control, but wars and political turmoil have allowed few to become a reality. Much of the area remains very poor and very rural, relying on rice farming and subsistence fishing.

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## Melanesia

BEGINNING WITH THE FRENCH explorer Jules d'Urville Dumont in the 1830s, geographers have grouped the far-flung islands of the PACIFIC OCEAN into three great island worlds: Melanesia, MICRONESIA, and POLYNESIA. Melanesia, derived from the Greek words for "black" and "islands," consists of those islands that extend from New Guinea in the northwest to the FIJI Islands in the southeast. This distance is approximately 3,500 mi (5,600 km). Melanesia includes, besides the large island of New Guinea, at least seven major island chains: the Admiralty Islands, the Bismarck Archipelago, the SOLOMON ISLANDS, the Santa Cruz Islands, the New Hebrides (now VANUATU), New Caledonia and nearby islands, and the Fiji Islands.

New Guinea was first settled by sea from Southeast Asia, perhaps as long ago as 40,000 years, and the practice of agriculture was under way in New Guinea by 9,000 years ago, one of the earliest dates for agriculture known in the world. The indigenous Melanesian peoples are all dark-skinned—hence the name "Melanesia"—and all practice agriculture with an emphasis on root and tree crops (taro, yams, sweet potatoes, coconut, and sago palms) and pig husbandry.

Settlements are small, although villages of up to 1,000 people exist in some areas, for example, in New Guinea's Sepik River Valley. Melanesia is still largely dependent on subsistence agriculture and most of the people live in rural areas. The largest city of today's Melanesia is Port Moresby, the capital of PAPUA NEW GUINEA. Port Moresby's population is approximately 300,000.

### TRADE ROUTES

Melanesian societies, though small and sometimes widely spaced, were not isolated. TRADE ROUTES, very often emphasizing trade in ceremonial objects, were very common. An example is the famous trade system described by anthropologist Bronislaw Malinowski. This "Kula" trade linked the various settlements of the Trobriand Islands near New Guinea into a single economic unit. Indigenous Melanesian peoples speak languages that can be grouped into two main divisions. Languages of the Austronesian or Malayo-Polynesian language family are spoken along the coast of northern and eastern New Guinea and also in the island groups east to Fiji. So-called Papuan languages (not a language family but a grouping of non-Austronesian languages that may or may not be related) are spoken in interior and southern New Guinea and in the Bismarck Archipelago.

Late in the 19th century, Melanesia was absorbed into the colonial empires of the NETHERLANDS, Great Britain, GERMANY, and FRANCE. In many cases, one European power would establish a colony only to prevent a rival colonial power from doing the same. The Netherlands absorbed the western half of New Guinea as part of the Dutch East Indies, now INDONESIA. Great Britain and later Australia colonized southeastern New Guinea. Great Britain also absorbed the southern Solomon Islands and the Santa Cruz and Fiji Islands. Germany, succeeded by Australia after World War I, colonized northeastern New Guinea, the Bismarck Archipelago, the Admiralty Islands, and the northern Solomon Islands including Bougainville. France took over New Caledonia and nearby islands, and, in a rather strange arrangement, administered the New Hebrides as a joint colonial possession with Great Britain. New Guinea was thus divided among three colonial powers; the Solomon Islands were divided in two.

In 1970, Fiji was the first Melanesian nation to achieve independence. Politically, Melanesia is now divided into the Indonesian province of Papua, formerly called Irian Jaya (population about 1.8 million); independent Papua New Guinea (population about 5.4 mil-

lion); the independent Solomon Islands (population about 523,000); independent Vanuatu, formerly the New Hebrides (population about 203,000); the independent Republic of Fiji (population about 881,000); and the French Overseas Territory of New Caledonia (population about 214,000). The total population of Melanesia today is thus about 9 million people, approximately 60 percent living in Papua New Guinea.

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## Mercator, Gerardus (1512–1594)

GERARDUS MERCATOR is the Latin name of Gerhard Kremer, one of the greatest geographers and cartographers, who lived in the 16th century. He was born on March 5, 1512, in Rupelmonde in the Flanders (now in BELGIUM), seventh child of Hubert and Emerentia Kremer. His father was a shoemaker. Thanks to his paternal uncle Gisbert Kremer, he went to Bois le Duc for two years to study philosophy and mathematics at Lovanio University, where he graduated as magister.

He studied under the guidance of mathematician Gemma Frisius and instrument maker Gaspar van der Heyden (Gaspar a Myrica). Mercator devoted himself to making mathematical instruments, such as astrolabes and armillary spheres, and to the art of the copperplate engraving, soon becoming so famous he received orders from the emperor, Charles V.

In 1534, he opened a house of cartographic production, and in 1537 he printed his first work, the map of Palestine *Amplissima Terrae Sanctae descriptio ad utriusque testamenti intelligentiam*, in six sheets. In 1538 he printed his map of the world and in 1540 the map of Flanders in four sheets. In 1540, his work *Litterarum latinarum quas italicas cursoriasque vocant scribendi ratio* was printed, written to uniform the toponymy and to use Latin handwriting on maps.

In 1544, in a moment of religious conflict during the Lutheran Reformation, Mercator was imprisoned



under suspicion of heresy, but he was released in a short time thanks to the help of some very eminent people. In 1552, he moved to Duisburg (GERMANY), where in 1554 he printed his map of Europe in 15 sheets that had a second edition in 1572. Mercator was appointed court cartographer by Duke Wilhelm of Cleve in 1564. During this year, the map *Angliae Scotiae et Hiberniae nova descriptio* was printed and in 1569 the great map of the world, *Nova et aucta orbis terrae descriptio*, in 18 sheets, was issued to help in navigation.

Thanks to this work, Mercator is heralded as the founder of modern cartography as a science, founding it on the mathematical method and not on the artistic empiricism prevalent at his time. He, for the first time, used a new way to draft maps with isogonic projection, today called the Mercator projection (1556). For the map to conserve the angles and the representation of the loxodromic curve with a straight line, Mercator's projection is used today also to draft navigation charts. On a globe, the lines of longitude (measuring east-west position) converge at the poles and the lines of latitudes (measuring north-south position) are at equal distance. In a Mercator projection, the lines of longitude are straight vertical lines at equal distance at all latitudes, and horizontal distances are stretched above and below the equator: this alteration is excessive near the poles. The Mercator projection mathematically stretches vertically distances from the same proportion as the horizontal distances so that shape and direction are conserved.

Mercator wished to compile a great encyclopedic work containing the entire geographical knowledge of the universe and the history of geographical science, but so great project was impossible to realize by one person only, and it remained unfinished. He started publishing the *Chronologia* (1569) and finally the *Atlas, sive cosmographicae meditationes de fabrica mundi et fabricate figura* (1585–95), republished complete only posthumously in 1602 by his heirs. This work is composed of a first part, *Galliae, Belgii Inferioris, Germaniae tabulae geographicae*, containing 51 maps, and a second part, with 29 maps, edited posthumously by his son Rumold. The *Atlas of Mercator* had in the following years several editions, the great part abridged. He was also the first to use the term *atlas* for a collection of maps.

Mercator also made an earth globe (1541) and a celestial globe (1551) with great success and built numerous duplicates. He was also the author of the philosophical work *De mundi creatione ac fabrica liber*,

written when he was still young but published only in 1592, *Evangelicae historiae quadripartite Monas, sive Harmonia quatuor evangelistarum*, to defend his *Chronologia* from the accusation of being mistaken about the birth year of Christ. On May 5, 1590, Mercator had a massive stroke that left his left side paralyzed. Frustrated since he could no longer work, he slowly recovered but suffered from his inability to continue his map making projects. By 1592, he was able to do a small quantity of work again, but he was almost blind. He had a second stroke at the end of 1593, which took away his ability to speak, and although he tried hard, regaining some speaking capability, a third stroke was fatal to him. Mercator died on December 2, 1594, in Duisburg.

The works of Mercator are regarded as the product of the synthesis of the Renaissance culture, critically reconstructing the text and maps of the past, and imposing a new scientific way to compile maps.

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## MERCOSUR

ON MARCH 26, 1991, the presidents of ARGENTINA, BRAZIL, PARAGUAY, and URUGUAY signed a common market agreement, the Treaty of Asunción, that set the basis for the creation of the Common Market of South America (MERCOSUR, or Mercado Común del Sur). MERCOSUR was the final step in a long struggle for economic and political cooperation in the region. The common market agreement has its origins in a previous agreement between Argentina and Brazil. The two most powerful countries in South America had signed in 1986 an agreement of economic and political cooperation known as the Argentine-Brazilian Economic

Integration Program (ABEIP). The MERCOSUR agreement called for the creation of a free trade zone and the full integration of the regional economies. Argentina and Brazil joined the common market in December 1994, and Paraguay and Uruguay a year later. Its most important dispositions included a progressive reduction of trade tariffs and the establishment of common external tariffs. The four countries also agreed on coordinating their macroeconomic policies. According to the treaty, trade tariffs would be progressively reduced. By 2000, as Jeffrey Cason explains, “their custom union has made duty-free in approximately 90 percent of all goods, and the four core member nations have agreed to a common external tariff on nearly all goods.”

MERCOSUR responded to both political and economic motivations. From a political perspective, it was an effort to guarantee regional political stability and consolidate democratic institutions. In a presidential summit in 1992, the four countries agreed that “an indispensable assumption for the existence and development of MERCOSUR is that democratic institutions are in force,” Peter Smith explains. This compromise was reinforced in 1998 in a meeting in Usuahia, Argentina, where the four MERCOSUR countries and two new associated members (CHILE and BOLIVIA) agreed on the compromise to defend democracy and maintain peace in the region.

From an economic perspective, MERCOSUR brought together the most important and stronger economies of South America in an effort for economic integration and liberalization of international trade. Brazil, however, has always played the leading and stronger role. MERCOSUR had an immediate impact on regional trade. Between 1990 and 1996, internal trade increased from \$4.1 billion to \$17.0 billion, according to Smith. MERCOSUR has also maintained discussions with the EUROPEAN UNION to create a free trade agreement.

Although MERCOSUR has been an important agent since the mid-1990s, it has also suffered from institutional limitations and faced strong barriers. The creation of a common market and a common custom system has been imperfect, and by 2000 there were still some conflicts and disputes with tariffs. In addition, the internal contradictions of the regional economies have limited the benefits and growth of a common market. The most visible contradictions have been the social and economic structures. During the 1990s, while this subregion concentrated about 200 million people, about 20 percent lived in poverty.

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## metric system

LEGALLY RECOGNIZED in the UNITED STATES by the Metric Act of 1866 but devised by French scientists in a 1791 report to the French National Assembly, the metric system of measurement is the decimal system of weights and measures based on the meter, liter, and gram with the prefixes deci-, deca-, and kilo-. Originally not universally accepted, the metric system, designed to simplify the traditional system of weights and measurement used in Europe, replaced all the traditional units of measurement except the units of time and angle measure. The establishment of the metric system is widely regarded as the first step in the development of the International System of Units (SI), which links all systems of weight and measures.

The SI, the modern version of the metric system, was established in 1960 by the 11th General Conference on Weights and Measurements. This intergovernmental treaty organization, which itself was created by the Meter Convention in 1875, is the international authority that ensures the dissemination and modification of the metric system to reflect the latest changes in science and technology. Linked to the SI through the Meter Convention is the International Bureau of Weights and Measurements. This organization’s mandate is to provide the basis for a single coherent system of measurement, through direct dissemination of units to coordinated international comparisons of national measurements standards, throughout the world.

The essential feature of the metric system of measurement, adopted by nearly every major industrialized country and viewed as a coherent system of units for physical science, is based on the length of a meter in relation to a platinum bar with a rectangular cross section and polished parallel ends. That is, the ideal behind the metric system was the use of only one measure per physically measured quality. Using the Earth as

the measuring stick, the meter, intended to be one ten-millionth part of the quadrant of the Earth, was defined at the Meter Convention as the distance between the polished end faces at a specified temperature. This definition was based on a measurement of a meridian between Dunkirk, FRANCE, and Barcelona, ITALY.

Later used as the prototype for the base units of length and mass, the meter along with the kilogram, were the models for a three-dimensional mechanical unit system of measurement. Endorsed by the American Metric Association (now the United States Metric Association) in 1916, the length of the meter served as the U.S. primary metric system standard until 1960.

The advantages to using the metric system, outside of being the world standard of measurement, are numerous. A few of its greatest advantages are that it has only one unit for each type of measurement that is easy to use and pronounce, it is never necessary to convert from one unit to another within the metric system, and there are no conversion factors to memorize. In addition, the metric system uses decimals instead of fractions or mixed numbers.

In relation to the prefixes, one of the mathematical advantages to using the metric system is the combination metric terminology with its decimal organization. Because there are several prefixes associated with a decimal position, they can be attached to the base metric unit in order to create new metric units.

In 1975, the United States, through the Metric Conversion Act and the United States Metric Board, designated the metric system of measurement as the preferred system of weights and measurements for trade and commerce, and it directed federal agencies, during the construction of federal facilities, to convert, when feasible, to the metric system. The Metric Conversion Act, amended by Executive Order 12770 in 1991 by President George H.W. Bush, directed agencies to convert to the metric system of measurement, designating the Secretary of Commerce to direct and coordinate this effort. The hope is that through uniform use of the metric system there will no longer be misunderstanding, confusion, or error in universal weights and measurements.

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## Mexico

**Map Page** 1136 **Area** 761,605 square mi (1,972,550 square km) **Population** 104,959,594 **Capital** Mexico City **Highest Point** 18,700 ft (5,700 m) **Lowest Point** -33 ft (-10 m) **GDP per capita** \$9,000 **Primary Natural Resources** petroleum, silver, copper, gold.



**OFFICIALLY KNOWN AS** the Estados Unidos Mexicanos (United Mexican States), Mexico is a country in North America. It is bordered by the UNITED STATES to the north, by the PACIFIC OCEAN to the west and south, by the Gulf of Mexico and CARIBBEAN SEA to the east, and by GUATEMALA and BELIZE to the southeast. Mexico has historically been a country of great mineral resources, ranging from silver to oil. The country has also become largely urban, as some two-thirds of the national population lives in cities, including MEXICO CITY, one of the largest metropolitan areas in the world.

Before the arrival of Europeans in the early 16th century, Mexico was home to several great Native American civilizations, including the Olmecs, Maya, and Aztecs. From the early-1500s until the 1820s, Mexico was part of the Spanish Empire in the New World. After gaining independence from SPAIN, Mexico became a republic in the 19th century. However, the



*Miramar Lagoon in Chiapas, Mexico, has the dense jungle terrain similar to the country's Central American neighbors.*



country lost much of its territory to the United States, including much of the present-day U.S. Southwest from TEXAS to CALIFORNIA.

The altiplano, also called the Mexican Plateau, rises from the border with the United States to the central Mexican highlands. Close to the U.S. border, the plateau reaches heights of about 4,000 ft (1,219 m); south of Mexico City, the altiplano has an altitude of some 8,000 ft (2,438 m). The altiplano is comprised of two parts. The northern section, from the U.S. border to San Luis Potosí, is a largely arid region known as the Mesa del Norte. To the south is the Mesa Central, which is higher, moister, and flatter. The Mesa Central contains a number of intermontane basins, many of which are fertile, and contains the country's largest settlements. The Guanajuato basin has historically been the "bread basket" of Mexico, providing much of the country's food.

### VALLEY OF MEXICO

The largest basins are those of Mexico, Puebla, and Guadalajara, all of which contain large cities of the same names. The Valley of Mexico, for example, has been the site of many great ancient Mexican civilizations, including the city of Teotihuacán, famous for its Temples of the Sun and Moon. The Aztec capital of Tenochtitlán was also in this basin. After the Spanish conquest of Mexico, the Spaniards built their colonial capital over the ruins on Tenochtitlán. Today, as part of a Federal District, Mexico City serves as the country's capital. Many of the valleys once had lakes that European settlers later drained and filled. In cities such as Mexico City, this practice has led to weak and unstable soils, often causing buildings to sink.

The altiplano is flanked by mountain ranges on each side. To the west is the Sierra Madre Occidental, which can reach 8,000 to 9,000 ft (2,438 to 2,743 m). River erosion in these volcanic mountains have led to the formation of many canyons, including Copper Canyon, the so-called Grand Canyon of Mexico. To the east is the somewhat lower Sierra Madre Oriental. To the east and west of the two mountain ranges are low plains that extend to the coast.

The altiplano is cut off by a string of volcanoes known as the volcanic axis that stretches from the Pacific to the Gulf coast. A number of the volcanoes are still active. Many of the volcanoes retain their Nahuatl-language names from the pre-Hispanic period. Located near Mexico City, Popocatepétl, or "smoking mountain," and Ixtaccíhuatl, or "white lady," reach over 17,000 ft (5,181 m).

To the east of the Cordillera Oriental is the Gulf Coast Plain. This lowland region stretches 900 mi (1,448 km) from Texas to the YUCATÁN PENINSULA. It consists of many lagoons and swamps to the east of the abrupt escarpment of the Cordillera. On the western side of Mexico is the narrower, less well-defined Pacific Coastal Lowlands. It runs for some 900 miles from the Mexicali Valley to Tuxpan. Despite the region's name, most of it actually faces the Gulf of California, not the Pacific Ocean. This lowland area is largely arid. However, it has also seen a rise in the importance of irrigated agriculture.

Baja California, or lower California, is a long, narrow peninsula that separates the Gulf of California from the Pacific Ocean. Most of the peninsula is mountainous and arid. However, agriculture has developed around Mexicali. There are also important fisheries on the peninsula. Tourism became an important economic activity at the end of the 20th century in areas such as Ensenada and Cabo San Lucas. Near the border with the United States, there are many factories known as *maquiladoras*, which use inexpensive Mexican labor to assemble products manufactured elsewhere.

South of the volcanic axis are the Southern Highlands, an area of old crystalline rock. This region is one of the most rugged areas of Mexico. The highlands are located to the south and east of "Old Antillia," which is believed to have once connected the Caribbean to the mainland. The Southern Highlands consist of steep ranges and valleys. On the southwestern side of the highlands is a series of ranges known as the Sierra Madre del Sur. These relatively low mountains often reach the sea, forming a rugged coastal margin. This area is sometimes called the Mexican Riviera because of the important tourist destinations such as Acapulco. The inland basins of the region are much less hospitable. To the northeast is the Mesa del Sur, with numerous valleys between 4,000 and 5,000 ft (1,219 and 1,524 m). The largest and most densely settled is the Oaxaca Valley, with its large native population.

### THE YUCATÁN

Located north of "Old Antillia," the Yucatán Peninsula, sometimes called the Antillean Foreland, is a flat area of limestone. The parts of the foreland that are above sea level form the Yucatán Peninsula, the largest lowland plains in Mexico. Because of the limestone's porous nature, there are few surface streams in the Yucatán. Water can be found instead in sinkholes known as cenotes. With the lack of water and a poor-quality soil, this region possesses little fertile land. Historically,



henequen was one of the region's most important crops. In the 20th century, resort areas such as Cancún and Cozumel located here, drawing tourists. The oil industry also developed in the area Yucatán in the 20th century.

The Chiapas Highlands are an extension of mountain ranges in Central America. The region consists of a series of mountains that surround the high rift valley of the Grijalva River. This hot and humid region of southern Mexico is remote and sparsely populated. Chiapas possesses rapidly shrinking forests of dyewoods and hardwoods. The region has also been a retreat for Native American groups such as the Lacandonese. In the 1990s, a group known as the Zapatistas began a rebellion in Chiapas to protest the plight of Mexico's Native American poor.

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## Mexico City

MEXICO CITY IS THE capital of the country of MEXICO. The city is located in the Valley of Mexico on the central Mexican plateau. The core of the city is comprised of the Federal District. However, the Mexico City metropolitan area goes well beyond the boundaries of the Federal District into the surrounding states. With a population of around 20 million, the Mexico City metropolitan area is one of the largest cities in the world.

The current site of Mexico City is located on top of Tenochtitlán, the capital of the Aztec Empire. The Aztecs founded Tenochtitlán in the 14th century on two small islands in Lake Texcoco. Three causeways connected the city to the mainland. Tenochtitlán grew into the largest city in the Americas before the arrival of Europeans.

When the Spanish arrived in the early 1500s, the city had a population of more than 100,000 people. The city contained a large and impressive marketplace at Tlatelolco. Tenochtitlán also possessed an extensive

palace complex for the Aztec emperors and hundreds of religious temples. The Spanish destroyed much of the city between 1519 and 1521.

After conquering the Aztecs, the Spanish constructed their own city over the ruins of the Aztec capital. Constant flooding soon led the Spanish to fill in the lakes in the Valley of Mexico. Mexico City came to be the biggest and most important city in the New World. It served as the capital of the Viceroyalty of New Spain and rivaled European cities in size and wealth. Much of the wealth from Mexico's silver mines made the city prosperous. Already by 1560, Mexico City had a university, the printing press, and large, impressive public buildings and churches. It served as the political, religious, economic, and cultural center of New Spain. Mexico City was also a study in contrasts, as along with the great wealth there was much poverty. There was also much ethnic diversity in the city, as the population consisted of Spaniards, Native Americans, and Africans, along with new racially mixed groups such as mestizos and mulattoes.

After Mexico achieved its independence from SPAIN, Mexico City became part of a Federal District, which the new government created in 1824 to serve as the political capital of the country. The city grew slowly in the first half of the nineteenth century. A number of important events and developments occurred starting around mid-century. During the 1840s, troops from the UNITED STATES occupied Mexico City. In the 1850s, during a movement simply known as La Reforma, the government expropriated Church lands in the city, which in turn led to an opening up of the real estate market beyond the historical central district. This situation led to the city's first significant population shift, as many elite families moved to the west. Mexico City expanded in the 1860s under Maximilian I, who built the well-known avenue Paseo del Emperador, today known as the Paseo de la Reforma. During the dictatorship of Porfirio Díaz, which began in 1876, Mexico City was greatly modernized along the lines of PARIS, showing much French influence. There were many improvements in utilities and services, such as a new drainage system, gas and electrical lighting, and streetcars. Improvement in urban transportation in particular allowed for the continued spatial expansion of the city.

From 1900 to about 1930, Mexico City experienced even more urbanization. During the Mexican Revolution of the 1910s, the population of Mexico City grew as many people fled the countryside. Building in the city resumed in 1924 with the construction



The current site of Mexico City is located on top of Tenochtitlán, the capital of the Aztec Empire.

of the Avendia Insurgentes. In this period, many members of the middle and upper classes moved to the south and west. The historic center of the city took on an increasingly bureaucratic function. Nevertheless, most residents still lived within the city proper. As late as 1930, 98 percent of the population lived within the city limits.

During the 1930s and 1940s, Mexico City experienced even more spatial and demographic growth. The earliest skyscrapers appeared in the 1930s, although the threat of earthquakes kept them small. The city became less concentrated, as residents moved north and south, in large part because of industrial expansion. More of the population lived in areas of the Federal District outside the legal limits of Mexico City.

Beginning about 1950, the city grew significantly because of a prospering economy fueled by oil exports. The population began to spill over the border of the Federal District into the state of Mexico. An example of the population movement was the 1957 creation of Ciudad Satélite, a middle-class suburban development. Population expansion continued in the 1960s with more industrial expansion and the growth of squatter settlements. For example, the squatter settlement of Nezahualcoytl grew from 65,000 to 650,000 in the 1960s, then reached 1.3 million by 1975. By the 1980s, nearly half of the city's population resided in slums and squatter settlements.

Mexico City hosted the Summer Olympics in 1968 and opened its subway the following year. The year 1968 also witnessed a massacre of student demonstrators at the Tlatelolco housing complex. The economic

crisis of the 1980s led to decreased spending on urban services even as the city grew in population. A major earthquake struck Mexico City in 1985, destroying many buildings and killing some 7,000 people. This earthquake led to a new construction code for the city. By the end of the 20th century, Mexico City faced a number of critical urban problems, including severe air pollution and major traffic congestion.

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## Michigan

IN THE NORTH-CENTRAL UNITED STATES, Michigan is known as the Wolverine State. Michigan entered the Union in 1837 as the 26th state, measuring 490 mi (788 km) north to south and 240 mi (386 km) east to west. The total area of Michigan is 96,716 square mi (250,493 square km), making Michigan the 11th-largest state. Michigan ranks 8th in population. Bordering on four of the Great Lakes, some 38,575 square mi (99,908 square km) of Michigan is made up of water from the Great Lakes. With only 56,809 square mi (147,134 square km) of land, Michigan ranks 22nd in land size. Lansing is the state capital. Other large cities include Detroit, Grand Rapids, Warren, Sterling Heights, Flint, Lansing, Ann Arbor, Livonia, Dearborn, and Westland.

Michigan is divided into the Upper and Lower Peninsulas, which were physically separated from one another until the construction of the Mackinac Bridge in 1957 provided easy access from one section to another. The Upper Peninsula, which is bordered on the north by Lake SUPERIOR, on the south by Lake MICHIGAN and Lake HURON, and on the west by WISCONSIN and MINNESOTA, is filled with low rolling hills and occasional swamps in the east and higher hills with a rugged terrain in the west. The eastern section of the Upper Peninsula is part of the Great Lakes Plain, while

the western section from Lake Superior into the Porcupine Mountains lies within the Superior Upland. The Upper Peninsula contains 34 rapids and waterfalls.

Two major landforms are found in Michigan's Upper Peninsula. The Eastern Upper Plains Lowlands are composed of flat lands interspersed with hills formed from glaciers. Agriculture is limited in this area, but state and national parks abound. Locks were used to eliminate a number of rapids and falls to facilitate travel between Lakes Huron and Superior. The Crystalline Upland, located in the western section of the Upper Peninsula, contains the Porcupine and Huron mountains and the Gogebic and Copper mountain ranges. Forestry is a major activity in this area.

The Lower Peninsula, which is also part of the Great Lakes Plains, is bordered on the west by Lake Michigan, on the east by Lake Huron and Lake Erie, and on the south by Indiana and Ohio. The terrain is made up of low rolling hills in the southernmost section and flat lands interspersed with hills in the northernmost section. The Lower Peninsula includes four major landforms. The Hilly Moraines, covering the bottom half of the area, is composed of moraines, or low ridges, occurring at 10- to 25-mi intervals. The Beaches and Dunes section of the Lower Peninsula is comprised of low forest-covered areas alternating with high bare dunes. The High Plains and Moraines section, located north of Muskegon-Saginaw Bay, contains higher ridges. The Eastern Lower Plains Lowlands, extending from the Saginaw Bay area to the tip of the Lower Peninsula, encompasses the most industrialized section of the state, including Detroit.

The humid continental climate of Michigan is tempered by the Great Lakes, which absorb heat in the summer months and cool off slowly during the winter months. The state experiences well defined seasons. Only Alaska ranks higher than Michigan as the wettest state in the United States. Average temperatures in Michigan range from 83 to 14 degrees F (28 to -10 degrees C). The highest elevation in Michigan is 1,979 ft (603 m) above sea level at Mount Arvon. The lowest elevation is 572 ft (174 m) above sea level where land meets Lake Erie.

Major rivers found in Michigan include the Detroit, the Grand, the St. Clair, and the St. Mary's. Rivers dammed to generate hydroelectricity include Manistee, Père Marquette, Muskegon, Grand, Kalamazoo, Saint Joseph, and Au Sable.

Michigan's flowering plants include arbutus, daisy, goldenrod, iris, lady's slipper, tiger lily, and violet. The apple blossom is the state's flower. Michigan's wildlife

includes squirrels, foxes, woodchucks, rabbits, deer, hares, porcupines, black bears, and bobcats. Moose and timber wolves are found on Isle Royale. The state's birds include robin (the state bird), thrush, meadowlark, wren, bluebird, oriole, bobolink, and chickadee. Michigan's game birds are geese, duck, grouse, pheasant, and quail.

Michigan's industries are chiefly concerned with manufacturing, services, tourism, agriculture, forestry and lumber. Home to Detroit, the automobile capital of the United States, automobiles and automobile products are the state's most lucrative industry. Other industries include the production of transportation equipment, machinery, fabricated metal, food products, plastics, cereals, machine tools, airplane parts, refrigerators, hardware, and office furniture.

Soil in the Upper Peninsula and in the top half of the Lower Peninsula are generally acidic grays and browns with limited fertility, while the most fertile section of the state is found in the heavy loams near Saginaw Bay and in the bottom half of the Lower Peninsula. Michigan's major crops include corn, wheat, soybeans, dry beans, hay, potatoes, apples, cherries, sugar beets, blueberries, and cucumber. Maple, oak, and aspen form the basis of Michigan's commercial timber/lumber industry. Minerals found in Michigan include iron, copper, iodine, peat, natural gas, shale, gypsum, bromine, salt, lime, and sand and gravel.

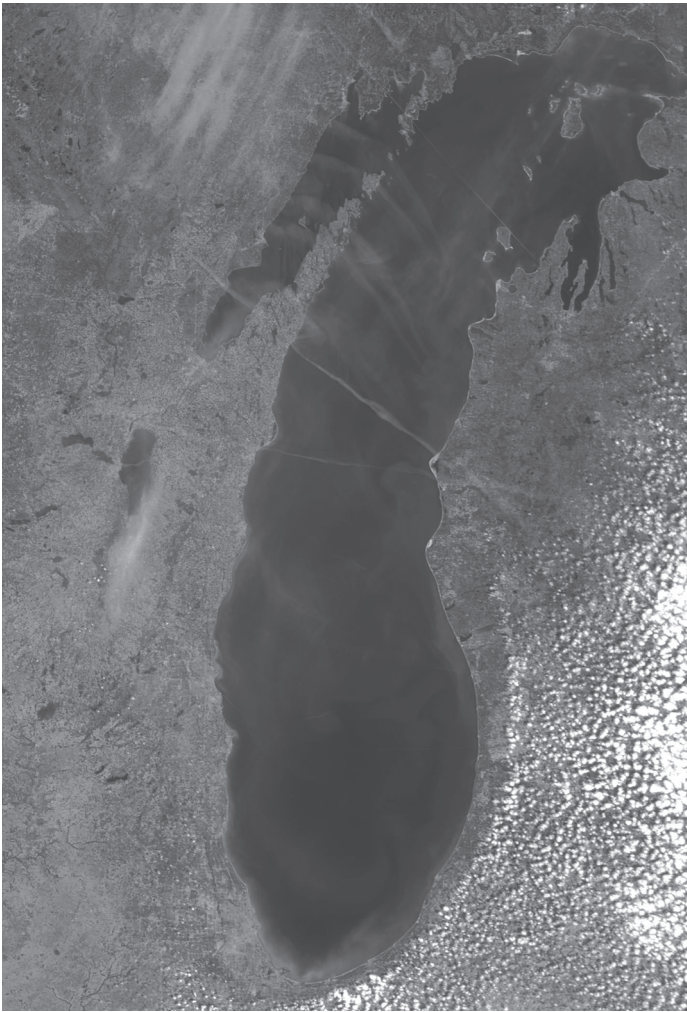
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## Michigan, Lake

LAKE MICHIGAN IS one of the five original Great Lakes, which are located near or along the border between the UNITED STATES and CANADA; a sixth lake,





*As seen from space, Lake Michigan's tear-drop shape is apparent. Chicago is at the bottom, left (Illinois) side of the lake.*

Lake Champlain, was added to the Great Lakes category in 1998. The Great Lakes are the largest group of freshwater lakes in the world, and Lake Michigan is the only one located entirely within the United States; its waters are contained within the states of INDIANA, ILLINOIS, WISCONSIN, and MICHIGAN.

This body of water is 22,300 square mi (57,800 square km). It has the third-largest surface area of the Great Lakes, and is the sixth largest lake in the world. It connects to Lake HURON through the Straits of Mackinac and the two lakes are, hydrologically speaking, inseparable. The lake's drainage basin, the area of land where streams and rivers that drain into the lake exist, nearly doubles the lake's scope at 45,600 square mi (118,000 square km). Rivers such as the Fox-Wolf, Grand, Kalamazoo, Menominee, Muskegon, and Saint Joseph are among the most notable. Via the Chicago

River, Lake Michigan also connects to the MISSISSIPPI RIVER basin and then the Gulf of Mexico.

Lake Michigan is 307 mi (494 km) long and 118 mi (190 km) wide, with an average depth of 279 ft (85 m) and a maximum depth of 925 ft (282 m). It contains 1,180 cubic mi (4,920 cubic km) of water, and averages 577 ft (176 m) above sea level. The shoreline is 1,638 mi (2,633 km) long when its island shorelines are considered.

The Great Lakes formed slowly; 600 million years ago, a shallow sea covered the area, and sand and silt deposited there gradually compressed into limestone, sandstone, and shale. The sea eventually dried up and about 1 million years ago, thick glaciers advanced and retreated over the land, carving large holes in soft sandstone and shale. Approximately 10,000 years ago, the last glacier retreated. As the Earth warmed up, the resulting water, called meltwater, filled the holes carved out of sandstone, and the Great Lakes were formed.

Lake Michigan's name also went through a series of changes. Explorer Samuel de Champlain named it Grand Lac in the early 17th century. Later names included Lake of the Stinking Water, and Lake of the Puants, after people living nearby, as well as Lac des Illinois, Lac St. Joseph, and Lac Dauphin. Explorers Louis Jolliet and Père Jacques Marquette gave this body of water the name by which we know it today, which is derived from a Native American designation, Michi-guma, meaning "big water."

The Sleeping Bear Sand Dunes, a spectacular feat of nature located in a national park, hovers 465 ft (142 m) above Lake Michigan and extends 35 mi (60 km) along its eastern shoreline. At this site, visitors can observe windswept dunes and other glacial formations.

A wide variety of fish live in Lake Michigan, including salmon, perch, bass, and walleye. Trout and whitefish are especially prized. By the late 1950s, many fish had been killed by an eellike creature called sea lamprey; although that problem has been alleviated, another greater problem still exists: pollution.

Lake Michigan's waters have been polluted from sewage and industrial waste, in part because its large surface area is a ready target for toxins falling from the atmosphere. At one time, Chicago's waste was dumped into the Chicago River, which flowed directly into Lake Michigan, and many other towns also dumped their raw sewage into the lake. Lake Michigan has a retention time of 99 years, which means that a molecule of water that enters the lake will, on average, take 99 years to leave its confines. Clearly, then, the contaminants entering the lake were accumulating; aggravating



the problem was the fact that Lake Michigan was a closed ecological system. Although many rivers flowed into the lake, none flowed out. To alleviate the pollution problem, engineers reconfigured the course of the Chicago River in 1900 so that it actually flowed away from the lake, thereby reducing the surge of sewage and chemical waste into Lake Michigan. Stricter environmental laws have also reduced the amount of industrial pollutants entering the water. In 1990, Congress passed the Great Lakes Critical Programs Act, which mandated more programs to reduce toxic pollutants so that Lake Michigan and other Great Lakes can be restored to a more healthful and stable condition.

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## microclimates

MICROCLIMATES ARE climates of small areas, such as gardens, cities, lakes, valleys, and forests. A microclimate is an expression of the temperature, humidity, and wind within a few feet or meters of the ground. Such expressions exist because surfaces vary in their ability to absorb, store, or reflect the sun's energy, making some areas warmer or colder, wetter or drier, or more or less prone to frosts. Microclimates may be natural or human made. They are important for their effects on comfort, crops, and natural surroundings.

Microclimates can extend for several miles because of the presence of large bodies of water, urban areas, and topography. Large bodies of water, such as the Great Lakes, Chesapeake Bay, and the ATLANTIC OCEAN, moderate temperatures of adjacent inland areas. Such water bodies store huge amounts of heat during the summer and release it slowly in winter. Consequently, land areas near the water tend to have low temperatures in winter that are not as cold or prone to fall and spring frosts. Small lakes and bays have the same but less extreme effects. Urban areas also have microclimates. In winter, buildings, parking lots, and streets of

cities absorb heat during the day, and then radiate it back into the air at night. Temperatures may be moderate enough to lengthen the growing season slightly in urban areas. In summer, the heating affect of concrete walls, metal and tile roofs, and asphalt parking lots can create sweltering temperatures. The excessive heat dries soils, wilts plants, and endangers the health of infants and the elderly. Topography also affects microclimates. In the Northern Hemisphere, south-facing slopes receive direct rays from the sun and are therefore warmer and drier than north-facing slopes. Additionally, cold air, which is heavier than warm air, tends to spill down mountain slopes and pool in valleys at night. Some valleys are 10 degrees F (18 degrees C) cooler than adjoining slopes on winter nights. Such valleys are at risk to frosts in late spring and early fall from the downslope drainage of cold air.

Microclimates can also be much smaller. The backyard has an assortment of possible small-scale microclimates. Surfaces of homes, balconies, rooftops, paved surfaces (such as patios, driveways, and sidewalks), lawns, trees, and soil types have subtle effects on the temperature, humidity, and motion of air. Like urban areas, a home absorbs heat during the day and radiates it back at night. Like mountain slopes, the side of a home facing the sun receives more solar energy and is warmer than the opposite side. Less cold-tolerant trees and shrubs are better suited to the side exposed to direct sunlight; hardier plants that are less prone to spring frosts can survive the cooler, shady side of the house. The eave of a smartly built roof hangs out over the windows just enough to shade the windows from the "high" sun of summer, but the overhang is not too far to block the "low" sun of winter. Fences, walls, and large rocks protect plants from wind and radiate heat. In winter, paved surfaces around the home absorb the day's heat and reradiate it at night, moderating nocturnal temperatures. The same solid surfaces also absorb and reradiate heat to moderate winter temperatures and to raise summer temperatures.

Gardeners, architects, and farmers change the ground surface (such as by changing the reflectivity or heat transmission of the surface or by modifying surface roughness) to create microclimates. Human-made microclimates can be deliberate or unintentional, large or small in scale. For instance, a skillful gardener creates several small-scale microclimates in a single garden to assure a variety of attractive flowers, shrubs, and trees. The gardener knows that certain plants benefit from the coolness of shade trees; other plants require windbreaks for protection from desiccating

winds; and plants that are frost sensitive do better near walls or large rocks that absorb and reradiate heat. Architects design landscapes, homes and office buildings to take advantage of sunlight, solar energy, wind direction, and water drainage.

Farmers utilize microclimates in similar ways in large fields; they select crops according to field exposure to sunlight and wind, as well as moisture retention capacity of the soil. Some of the largest changes that people make to microclimates are unintentional results of widespread suburbanization, forest clearance, and agricultural expansion. Alterations of microclimates will not affect the general climate of a region, but the change can and does result in large local changes in climatic conditions.

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## Micronesia

**Map Page** 1128 **Area** 271 square mi (702 square km) **Population** 108,143 **Capital** Palikir **Highest Point** 791 m (2,595 ft) **Lowest Point** 0 m **GDP per capita** \$1,760 **Primary Natural Resources** forest products, fish, marine products, deep sea minerals.



MICRONESIA CONSISTS of four Pacific island groups located between the Marianas and MARSHALL ISLANDS, 1,000 mi (1,600 km) north of PAPUA NEW GUINEA and some 3,000 mi (4,500 km) west of HAWAII. Although they cover an expanse of ocean larger than Western Europe, the total land mass of the 607 islands in the four groups is approximately that of a medium-size city.

A stone fortress built on a reef at Nan Madol gives evidence of advanced human occupation by 500 C.E. Discovered by Spanish explorers in the early 16th century, the islands of Micronesia were originally called

New Philippines but were renamed the Caroline Islands around 1700.

Micronesia's islands include the high volcanic groups around Pohnpei, Kosrae, and Chuuk (Truk), as well as those around Yap, which are part of a raised section of the Asian continental shelf. All have tropical climates, abundant rainfall, and sparse populations. Pohnpei is a rocky, circular island with steep cliffs, tropical jungles, and extensive mangrove swamps. Kosrae is a solitary island with few outlying islets, and is encircled by a large coral reef. Chuuk includes 15 large islands, 192 outer islands, and 80 islets and atolls, with a total population of 50,000 people. Yap includes four main islands and 10 islets within the bounds of a large coral reef and 130 outer islands.

European colonial powers became interested in the islands in the early 19th century when whaling vessels began operating in the South Pacific. Westerners brought new languages, new religions, and new illnesses. A smallpox epidemic in 1854 killed half of Pohnpei's native population. In 1899, GERMANY purchased most of the Micronesian islands from SPAIN, but lost them to JAPAN, which seized them in World War I. In December 1941, Japan used its outposts in Micronesia to launch attacks on nearby islands, including Guam. The UNITED STATES oversaw the islands after World War II, and sponsored their transition to independence in 1991.

Micronesia's islands have no native mammals, but they do support a large array of marine and plant life, birds, and insects. The islands have one of the most uniform year-round temperatures in the world, at 81 degrees F (27 degrees C).

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## Mid-Atlantic Ridge

A MID-OCEAN RIDGE is a system of rifts and parallel mountain ranges or hills found in all major oceans. It is thought to be the site of upwelling new ocean floor

material from Earth's mantle, from which ocean floors are gradually spreading out laterally. The Atlantic ridge is the most striking bottom relief feature of the ATLANTIC OCEAN.

A German oceanographic vessel, *Meteor*, discovered the ridge. The ridge, which is shaped like the letter "S," extends for 9,000 mi (144,000 km) across the ocean from north to south, and seldom falls more than 13,290 ft (4,000 m) below sea level. It is a submarine longitudinal rise traversing the ocean from ICELAND in north through the equator to BOUVET ISLAND in the south. The general course of the ridge is parallel to the coastline of the bordering continent and throws off many branching ridges towards the coast. Following the curves of the coastline and remaining in the center of the ocean, it divides the Atlantic into two broad deeper basins on either side, which are further divided into many subbasins. The greater part of the ridge is submerged below sea level and its central backbone rises 5,000 to 10,000 ft (1,430 to 3,000 m) above the sea floor. The width of the ridge also varies from north to south. The Northern Atlantic ridge is known as Dolphin rise and the southern part is named Challenger rise.

The ridge, though under the sea level, has many peaks thrust out above the surface of the ocean. These peaks are the islands of the mid-Atlantic, for example, the AZORES and CAPE VERDE Islands. The sharpest peak of the Atlantic ridge is the cluster of islets known as Rocks of St. Paul near the equator. In the South Atlantic, the ridge produces ASCENSION and ST. HELENA islands.

The Atlantic ridge rises near Iceland. Between Iceland and Scotland, this ridge is known as the Wiley Thompson ridge and forms the boundary between the Atlantic and Arctic oceans. South of the continental shelf of GREENLAND and Iceland, the ridge widens near about 55 degrees N, where the depth of water is between 7,000 and 10,500 ft (2,000 and 3,000 m). This part is known as Telegraph plateau.

To the west of this plateau near 40 degrees N, the ridge bifurcates toward the Newfoundland coast bounded by the contour of 10,500 ft (3000 m). It is known as the Newfoundland rise. Moving southward in the middle of the ocean up to 12 degrees N, the Central Atlantic ridge follows the southwest direction between the coast of Africa and America. Here it is seldom broken and disrupted. South of 40 degrees N, the Atlantic ridge widens toward the coast of Africa, and here the Azores rise bifurcates from the Central ridge. At the equator, the Sierra Leone rise bifurcate to-

ward the northeast coast of Africa, and the Para rise moves to northwest coast of South America.

At 10 degrees S, the Guinea rise, formed by a contour that is 10,500 ft (3,000 m) deep and less, runs northeast toward the Guinea coast. The ridge bifurcates near 40 degrees S, where the Central ridge has the maximum breadth of 600 mi (960 km). Walvis Ridge is bifurcated from here and merges into the African continental shelf. To the west, the Rio Grande rise is between 10,500 and 14,000 ft (3,000 and 4,000 m) and moves toward the coast of South America to 30 degrees S. Here is the Bromley Plateau, at a depth of 2,437 ft (697 m). After 40 degrees S, the central ridge moves toward the southeast and forms Meteor Bank and Cape Swell, near 45 degrees S. It proceeds toward the Cape of Good Hope, south of which it is known as the Mid Atlantic-Antarctic ridge.

The origin of the ridge is attributed to compression and continental drift. The evolution of the mid-Atlantic rise could be dated back to the Pliocene age. The volcanoes are found on the central ridge from Iceland to Bouvet. Some differential horizontal movement is in progress here. Such movements bring strips of crystal rocks near the sea level. The pattern of the Atlantic floor is suggestive of east-west stretching. It is postulated that the horizontal mantle motion between the zone of rising mantle rock (midocean ridge) and sinking rock (beneath the island and mountain arcs) exerts a dragging force on the lithospheric plates.

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## Middle East

THE TERM *Middle East* came to modern use after World War II, and was applied to the lands around the eastern end of the MEDITERRANEAN SEA including TURKEY and GREECE, together with IRAN and, more recently, the greater part of North Africa. The old Middle East began at the river valleys of the Tigris and the Euphrates rivers or at the western borders of Iran and extended to Burma (MYANMAR) and Ceylon (SRI LANKA).

Some geographers today say the Middle East region stretches 6,000 mi (9,656 km) eastward from the dry Atlantic shores of MAURITANIA to the high mountain core of AFGHANISTAN. Other geographers begin the Middle East with EGYPT. It includes numerous separate political states, most of which were created by colonial government cartographers in the 19th and 20th centuries. A good deal of the Middle East is too dry or rugged to sustain human life, and only 5 to 10 percent of the entire region is cultivated. As a result, a stark contrast exists between core areas of dense human settlement where water is plentiful, and the empty wastes of surrounding deserts and mountains.

Four regions can be identified in this vast, diverse, and distinct area: the Northern Highlands, a 3,000-mi- (4,828-km-) long zone of plateaus and mountains in Turkey, IRAN, and AFGHANISTAN, stretching from the Mediterranean Sea to Central Asia; the Arabian Peninsula, a million-square-mi- (2.6-million-square-km-) desert quadrilateral jutting southward into the INDIAN OCEAN and flanked on either side by the Persian (or Arabian) Gulf and the RED SEA; the Central Middle East, the rich valleys of the NILE in Egypt and of the Tigris and Euphrates in IRAQ, and the intervening fertile crescent countries of ISRAEL, JORDAN, LEBANON, and SYRIA; and North Africa, a band of watered mountains and plains set between the SAHARA DESERT and the Mediterranean Sea. Known by the Arabs as al Maghrib al Aqsa ("Land of the Setting Sun"), it includes the nations of TUNISIA, ALGERIA, MOROCCO, and LIBYA.

### THE NORTHERN HIGHLANDS

The Taurus and ZAGROS MOUNTAINS of southern Turkey and western Iran form a physical and cultural divide between Arabic-speaking peoples to the south and the plateau-dwelling Central Asian people of Turkey, Iran, and Afghanistan. Around one-third of the people of the Middle East and North Africa live in the Northern Highlands, on the Anatolian and Iranian plateaus and the flanks of the HINDU KUSH range of Afghanistan.

Turkey is a large, rectangular peninsula plateau bounded on three sides by water—the BLACK SEA on the north, and the AEGEAN SEA to the west, and south. The Turkish coast is rainy, densely settled, and intensively cultivated. About 40 percent of the population is clustered onto the narrow, wet Black Sea coast, on the lowlands around the Sea of Marmara in both European and Asiatic Turkey, along the shores of the Aegean, and on the fertile Adana Plain in the southeast.

By contrast, the center of Turkey—the dry, flat Anatolian Plateau—is sparsely settled. Cut off by the

Pontic Mountains to the north and the Taurus to the south, the dead heart of the plateau is too dry to sustain dense agricultural settlement; in the east, the rugged terrain of the Armenian highlands limits agricultural development.

Although the environmental base of Iranian society is similar to Turkey's, the topography is more dramatic, and contrasts are more sharply drawn. High mountains ring the dry Iranian Plateau on all sides except the east.

In the west and south, the folded ranges of the Zagros Mountains curve southeastward for a distance of 1,400 mi (2,253 km) from the northwest Turkish frontier to deserts of Sistan in the southeast. In the north, the steep volcano-studded ELBURZ range sharply divides the wet CASPIAN SEA coast from the dry Iranian interior. The encircled plateau covers over half the area of Iran, with large uninhabited stretches of salt waste in the Dashti Kavir to the north and of sand desert in the Dashti Lut to the south.

Along the Caspian Littoral, which receives up to 60 in (152 cm) of rainfall per year, the intensive cultivation of rice, tea, tobacco, and citrus fruits supports a dense rural population. Similarly, in AZERBAIJAN in the northwest and in the fertile valleys of the northern Zagros, rainfall is sufficient to support grain cultivation without irrigation. But in the rest of Iran, rainfall is inadequate and crops essentially require irrigation. Oasis settlement based on wells, springs, or underground horizontal water channels called qanats is common.

In the small remote country of Afghanistan, the easternmost nation of the Northern Highlands, the processes of population growth, agricultural expansion, and urbanization have barely begun. The country's center is occupied by the ranges of the Hindu Kush; a rugged, snowbound highland that is one of the least penetrable regions in the world. Deserts to the east and south are cut by two major rivers, the Hari Rud and the Helmand, both originating in the central mountains of Afghanistan and disappearing into the deserts of eastern Iran. In the north, the AMU DARYA (Oxus) flows into the Russian STEPPE. Settlements are found in scattered alluvial pockets on the perimeter of the Hindu Kush, where there is level land and reliable water supplies.

Over 70 percent of Afghanistan's population lives in the scattered villages as cultivators of wheat and barley and herders of small flocks of sheep and goats. An additional 15 percent are nomadic tribesmen, whose political power is still felt in this traditional society. In central and eastern Afghanistan, Pathans are domi-





*A good deal of the Middle East is too dry or rugged to sustain human life, and only 5 to 10 percent of the entire region is cultivated. A stark contrast exists between core areas of dense human settlement where water is plentiful and the surrounding deserts and mountains.*

nant; in the north, the Turkish-speaking Uzbeks and Persian-speaking Tadzhiks predominate.

### THE ARABIAN PENINSULA

The Arabian Peninsula may be described as a great plateau sloping gently eastward from a mountain range running along the whole length of its west side. It is a huge desert fault bounded on three sides by water and on the fourth by the deserts of Jordan and Iraq. In the west, the rugged slopes of the Hijaz and the highlands of YEMEN form the topographical spine of this platform. The remainder tilts eastward to the flat coasts of

the Persian Gulf, rising only in the extreme southeast to the height of the Jabal al Akhdar (Green Mountains) of Oman.

Although the peninsula is the largest in the world and nearly four times the size of the state of TEXAS, it supports a population of less than 18 million people. The majority of these people live in two nations: SAUDI ARABIA (25.79 million, excluding 5.57 million non-nationals), which governs nine-tenths of this region, and Yemen (20 million), whose highlands trap sufficient moisture to support cultivation without irrigation. Smaller states on the eastern and southern perimeters

of the peninsula include KUWAIT, QATAR, the UNITED ARAB EMIRATES, and OMAN.

Although the TROPIC OF CANCER bisects the Arabian Peninsula, passing south of Medina, Riyadh, and Muscat, most of the southern half of the peninsula is too high or isolated to be characteristically tropical, the main exception being the lowland coast. The principal historical determinant of human settlement in the peninsula has been the availability of water. Overall, the region receives less than 3 in (7.62 cm) of rainfall each year, with a bit more in the north. Only the highlands of Yemen and Oman at the southern corners of the peninsula receive more than 10 in (25.4 cm). Daily temperatures commonly rise above 100 degrees F (37.7 degree C).

Fully one-third of the central plateau is covered by a sea of shifting sand dunes and much of the rest lies under boulder-strewn rock pavement. In the southern desert, the forbidding Rub al Khali (Empty Quarter), wind-worked dunes 500 to 1,000 ft (152 to 305 m) high, cover an area of 250,000 square mi (402,336 square km) to form a bleak, rainless no-man's-land between Saudi Arabia and the states of the southern coast. Arching northward from the Rub al Khali, a 15-mi- (24-km-) wide river of sand, the Ad Dahna, connects the southern sands with the desert of Nafud 800 mi (1,287 km) to the north.

Given this harsh environment, the Arabian landscape has no permanent lakes or streams. Vegetation is sparse. Settlement is confined to oases, and only 1 percent of the region is under cultivation. Vast stretches of the peninsula are completely uninhabited, devoid of human presence except for the occasional passage of Bedouin camel herders.

Within this difficult physical setting, two-thirds of the people of the Arabian Peninsula are rural agriculturalists, seminomads, and nomads. Their lives focus on oasis settlements where wells and springs provide water for the cultivation of dates—the staple food of Arabia—and the maintenance of herds of camels, sheep, and goats. The distribution of these oases is determined by a network of dry river valleys (wadis) carved into the surface of the plateau in earlier and wetter geological periods. These wadis provide the most favored locations for commercial and agricultural settlement and the most convenient routes for caravan traffic.

In the western highlands, where population density is above average, the largest urban centers are Mecca, Medina, and Taif. In central Arabia, underground water percolates down from these uplands and surfaces

through artesian (gravity-flow) wells, creating a string of agricultural oases both north and south of the Saudi Arabian capital of Riyadh. Farther east, on the shores of the Persian Gulf, this same water emerges as fresh-water springs in Kuwait, eastern Saudi Arabia, and the United Arab Emirates. Similarly in South Yemen, springs in the Wadi Hadramuat, a gash several hundreds miles long parallel to the coast of the Gulf of Aden, provide the basis for oasis settlement. Only in Yemen and Oman is this dryland oasis pattern broken.

Today, oil resources in Saudi Arabia, Kuwait, the island state of BAHRAIN, the United Arab Emirates, and, to a lesser extent, Qatar and Oman are providing the capital for rapid economic growth, leaving the southern states of Yemen and South Yemen in isolated poverty. In the gulf, cities like Dhahran, Dammam, Ras Tannurah, Kuwait City, Manamah (the capital city of Bahrain), and emirate centers like Abu Dhabi, Dubai, and Sharjah are creations of the oil industry. Less directly but equally dramatically, the traditional centers of Riyadh (population: 3.5 million), Mecca (550,000) and Jeddah (2.8 million) are growing rapidly as farmers and Bedouins seek salaried employment in expanding urban industries.

### THE CENTRAL MIDDLE EAST

The Central Middle East is flanked to the west and east by two great river valleys, the Nile of Egypt and the Tigris-Euphrates system in Iraq. Between these riverine states, the small nations of Israel, Lebanon, and Syria line the shores of the eastern Mediterranean; Jordan is LANDLOCKED.

The environments of these nations are as complex as their histories. Four millennia of human civilization have left an essentially denuded landscape—barren hills, steppes overgrazed by sheep and goats, and rivers choked by the erosional silt of human activity. In Egypt, the Nile Valley, a narrow trough 2 to 10 mi (3.2 to 16 km) wide cuts northward across the dry plateau of northeastern Africa to the Mediterranean Sea. East of the Nile Valley, the heavily dissected Eastern Highlands border the coast of the Red Sea, continuing past the Gulf of Suez into the SINAI PENINSULA. Barren and dry, these highlands are occupied by nomadic herders.

The sources of the Nile River lie 2,000 mi (3,218 km) south of the Mediterranean in the wet plains of the Sudan and the equatorial highlands of East Africa. The Nile's largest tributary, the White Nile, originates in Lake Albert and Lake VICTORIA and flows sluggishly through a vast swamp, the Sudd, in southern Sudan, before entering Egypt. The other major tributaries, the

Blue Nile and the Atbara River, flow out of the Ethiopian highlands, draining the heavy summer rains of this region northward toward the desert. This summer rainfall pours into the Nile system, causing the river to flood regularly from August to December, and raises its level some 21 ft (6.4 m).

For centuries, this flood formed the basis of Egyptian agriculture. Specially prepared earth basins were constructed along the banks of the Nile to trap and hold the floodwaters, providing Egyptian farmers with enough water to irrigate one and, in some areas, two crops of wheat and barley each year.

In the 20th century, British and Egyptian engineers constructed a series of barrages and dams on the Nile to hold and store the floodwater year-round. This transformation of Nile agriculture was largely completed in 1970 with the construction of the Aswan High Dam, a massive earthen barrier more than 2 mi (3.2 km) across, 0.5 mile (0.8 km) wide at the base, and 120 ft (37 m) high.

Behind it, Lake Nasser, the dammed Nile River, stretches 300 mi (483 km) southward to the Sudanese border. The dam added about one-third to the cultivated area of Egypt. Hence, Egyptian population expanded from estimated 10 million at the turn of the century to its current 76 million. During this same period, urban population expanded eight times, and Cairo (7.76 million) and Alexandria (3.9 million) emerged as the two largest cities on the African continent.

In contrast to Egypt, the central problem in the other great river valley of the Middle East, the Tigris-Euphrates of Iraq, is not overpopulation but environmental management. Both these rivers rise in the mountains of eastern Turkey and course southward for more than 1,000 mi (1,609 km) before merging in the marshes of the Shatt al Arab. North of Baghdad, both rivers run swiftly in clearly defined channels. To the south, they meander across the flat alluvial plains of Mesopotamia. East of the valley, the Zagros Mountains rise as a steep rock wall separating Iraq from Iran.

To the west, a rocky desert plain occupied by nomadic herders stretches the borders of Saudi Arabia, Jordan, and Syria. Only in the northeast, in the Kurdish hills, does rainfall sustain non-irrigated cultivation. Elsewhere in Iraq, human existence depends on the water of the Tigris and Euphrates rivers. But unlike Egypt, where every available acre of farmland is intensively utilized, Iraq's agricultural resources are largely wasted.

The Tigris and Euphrates rivers have always proved less manageable than the Nile. Fed by melting snows in Turkish highlands, spring floods 8 to 10 ft (244 to 309 cm) above normal pour down the river channels to Baghdad and then spread out over the vast plains of Mesopotamia, where the land is so flat that elevations change only 4 to 5 ft (122 to 152 cm) over distances of 50 mi (80 km).

In the Fertile Crescent countries of Syria, Lebanon, Jordan, and Israel, which lie along the eastern coast of the Mediterranean between the river valleys of Egypt and Iraq, environmental patterns are extremely complex. The coastal plain, narrow in the north but widening southward, is backed by dissected, rugged highlands that reach elevations of more than 10,000 ft (3,048 m) in Lebanon. Throughout their length, these uplands have been denuded of forests, notably the famous cedars of Lebanon, by centuries of overgrazing and cutting for economic gain. Winter rainfall is plentiful in the north but less in the south. In Syria, the highlands capture this ample rainfall in stream that support life in the oasis cities of Aleppo, Homs, Hama, and Damascus. In Lebanon and northern Israel, runoff from the highlands sustains important commercial and agricultural areas along the coast. Further south, the highlands flatten out into the rainless wastes of the NEGEV DESERT.

Inland, a narrow belt of shallow, flat-bottomed intermontane valleys separates these western highlands from the dry uplands plateaus and mountains of the east. Between Israel and Jordan south of the Galilee, the Jordan River flows along one of these valleys 150 mi (241 km) southward to the Dead Sea, 1300 ft (396 m) below sea level. Farther north, a similar trough in Lebanon, the Beqaa Valley, is drained by the Litani and Orontes rivers. East of these lowlands, rugged highlands grade inland to the grass-covered steppes of Syria in the north and the dry stone pavement of the Jordanian desert in the south. In this varied terrain, the distribution of population is extremely uneven.

## NORTH AFRICA

North Africa is the largest subregion of the modern Middle East, covering an area larger than the United States, but inhabited by only 50 million people grouped together on the southern shore of the Mediterranean Sea between water and sand. Much as Egypt is truly the gift of the Nile, cultural North Africa is the result of a physiographic event, the ATLAS MOUNTAINS, which separate the Sahara Desert from the Mediterranean Sea and Europe beyond.

Most of the territory of the modern nations of Maghreb-Morocco, Algeria, Tunisia, and Libya consists of Saharan wastelands that stretch 3,000 mi (4,828 km) across Africa from the Atlantic Ocean to the Red Sea. One-seventh of this area is sand dunes; the remainder is rock-strewn plains and plateaus. Aridity in the Sahara is not interrupted even by the jutting peaks of the AHAGGAR and TIBETSI massifs at 6,000 ft (1,829 m) which receive as little as 5 in (12.7 cm) of rainfall per year. Here, as well as in other scattered Saharan oasis environments, an estimated 3 million people wrest a living from what is Earth's most difficult cultural environment outside the polar regions. Only in the north, along the mountain-backed coast of the Mediterranean, is rainfall sufficient to sustain substantial concentrations of people. The Atlas Mountains form a diagonal barrier isolating the nomads of the deserts and steppes of the south and east from sedentary agriculturalists in the Mediterranean north.

The Spanish Sahara was the only North African country that was totally desert. Before the recent discovery of extensive phosphate deposits in the north and the possibility of rich iron ore lodes, this territory was of little interest to anyone, but both Morocco and Mauritania have claimed sovereignty. With the departure of SPAIN in 1976, the territory has been divided between its two larger neighbors.

In Morocco, the Atlas Mountains form a succession of four mountain ranges dominating the landscape. In the north, the Rif, which is not geologically associated with the Atlas, is a concave arc of mountains rising steeply along the Mediterranean, reaching elevations of 7,000 ft (2,134 m) and orienting Morocco toward the Atlantic. In the center of Morocco, the limestone plateaus and volcanic craters of the Middle Atlas reach elevations of 10,000 ft (3,048 m); contact with Algeria is channeled through the Taza corridor, and this mountain barrier has isolated the Moroccan Sahara until modern times. Farther south, the snow-capped peaks of the High Atlas attain elevations of 13,400 ft (4,084 m) and separate the watered north from life in the Sahara. Finally, the Anti-Atlas, the lowest and southernmost of the Moroccan ranges, forms topographic barriers to the western Sahara. Historically, the Atlas range has provided a refuge for the original Berber-speaking inhabitants of Morocco, whose descendants today make up half the nation's population.

Throughout mountainous Morocco, Berber populations maintain an agrarian tradition of transhumance of goats and sheep wedded to cultivation of barley,

centered around compact mountain fortresses. Density of settlement in the mountains depends on rainfall, which in general diminishes from west to east, and on altitude, which prohibits year-round settlement because of cold winter temperatures in areas much over 6,000 ft (1,829 m). Most of Morocco's 32.2 million people are Arabic-speaking farmers who till the fertile lowlands plains and plateau stretching from the Atlantic to the foothills of the Atlas.

Farther east along the Atlas complex, the primary environmental contrast in Algeria is once again the distinction between the fertile, well-watered, and densely settled coast and mountain ranges of the north and the dry reaches of the Sahara Desert in the interior. The Algerian coast is backed by the Tell Atlas, a string of massifs 3,000 to 7,000 ft (914 to 2,133 m) in elevation, which have formed an important historical refuge for Berber-speaking tribes. In the interior, a parallel mountain range, the Saharan Atlas, reaches comparable elevations in a progressively drier climate. Between these two ranges in western Algeria, the high plateaus of the Shatts, a series of flat interior basins, form an important grazing area. In eastern Algeria, the two ranges of the Atlas merge to form the rugged Aures Mountains. South of these ranges, Algeria extends 900 mi (1,448 km) into the heart of the Sahara.

In Tunisia and Libya, the topography is less dramatic than in Morocco and Algeria, but the same environmental sequence from northern coast to southern desert prevails. Two-thirds of Tunisia's 9.9 million people live in the humid northeast and in the eastern extension of the Arres Mountains. The central highlands and interior steppes, marginally important in the past, have become sites of innovative development projects. Tunisia remains an example of self-motivated and successful state planning. In Libya, the population (5.6 million) is concentrated on the coast in the hilly back country of Tripolitania and Cyrenaica.

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## migration

MIGRATION IS referred to as “any residential movement which occurs between administrative units over a given period of time,” according to geographers Paul White and Robert Woods (1980). Other scholars have defined migration as the change in the center of gravity of an individual’s mobility pattern. The destinations of the mobility flows need not, themselves, change as a result of the change in their center of gravity.

For example, in the local intraurban move, the destinations of journey-to-work, recreation, and shopping may remain the same, while in an interurban move, they are likely to change. The perception of spatial differentiation of opportunities—the idea that different geographical locations offer different levels of potential well-being to various sections of human population—explains why migration occurs. It is these perceived differences between places that are important rather than any simple “push and pull” mechanism.

Hence, migration occurs because migrants believe that they will be more satisfied in their needs and desires in the place that they move to rather than the place from which they come. An importance must be placed on the word *believe*. Migration occurs as a result of decisions made by individuals in the light of what they perceive the objective world to be like: it does not matter if the migrant holds an erroneous view—it is that erroneous view that is acted upon rather than the objective real-world situation. Thus, there may be cases where migration occurs despite the lack of an objective reason for it, and other cases where an objective appraisal of the world, were it possible, might suggest that migration should occur where it is, in fact, absent.

In recent times, international migration is at record levels and is unlikely to slow down in the near future. The number of long-term international migrants (that is, those residing in foreign countries for more than one year), according to the United Nations Population Division, in 1965 was only 75 million, but that number rose to 84 million by 1975 and 105 million by 1985. There were an estimated 120 million migrants in 1990,

the last year for which the detailed statistics are available. In the 1990s, migration growth continued with the same pace; hence, in 2000, an estimated 150 million people resided outside their county of birth or nationality. Even with the numbers of international migrants large and growing, it is important to keep in mind that less than 3 percent of the world’s population has been living outside their home countries for a year or longer.

International migrants come from all parts of the world and they go to all parts of the world. In fact, only a few countries are unaffected by international migration. Many countries are sources of international flows, while others are net receivers, and still others are transit countries through which migrants pass to reach to receiving countries. Such countries as MEXICO experience all three capacities, as source, receiving, and transit countries.

The noteworthy fact about migration is that it tends to be within regions; migrants often remain within the same continent. More than half of international migrants traditionally have moved from one developing country to another. In recent years, however, migration from poorer to richer countries has increased significantly. While the traditional immigration countries—the UNITED STATES, CANADA, and AUSTRALIA—continue to see large-scale movements as a result of labor recruitment that began in the 1960s and 1970s, Europe, the oil-rich Persian Gulf states, and the “economic tigers” of East and Southeast Asia are now also major destinations for international migrants.

### MIGRATION IN PREINDUSTRIAL SOCIETIES

In the history of migration, there is no comprehensive evidence of migration until the 19th century, however, information from census and vital registration provides indirect evidence of the nature of migration. It was once thought that there was little migration in pre-industrial societies, on the grounds that transportation was slow, costly, and often dangerous, and that institutions such as serfdom—or, in England after the 16th century the laws of settlement—hindered mobility. There is evidence supporting this view. In 1841, when four-fifths of Sweden’s population lived in rural areas, 92.8 percent of the population was still in the country in which they had been born.

Research on parish registers shows that most women married men from their own or nearby villages; until after 1750, four-fifths of all French women married men from places within a few miles or kilometers of their village. But it does not follow from this

that preindustrial communities were completely isolated and lacked mobility. Studies of English villages in Tudor and Stuart times suggest a remarkable turnover in inhabitants' names that can only be explained by migration, albeit of short distances. A study of 10 parishes near York, England, shows that of the inhabitants at the end of 18th century, only 40 percent had ancestors there in 1700.

Before 1000, villages were the basic unit of rural settlement; in the following centuries people moved into the woodland between the primary settlements and established hamlets and isolated farmhouses; by the middle of the 13th century, there was little good farmland left, and there was a movement on to marginal land. Many of the upland areas of Europe were settled for the first time—in NORWAY, in the French ALPS, and in the Vosges and the PYRENEES.

The long-distance movement was more dramatic between 1050 and 1340; there was a movement of Germans east of the Elbe River into sparsely populated Slav areas; in the 12th and 14th centuries, some 400,000 moved into this area. In southern Europe, the principal movement was by the Spanish southward into the Muslim-occupied areas of Iberia. But while these two movements have received much attention from geographers and historians, they were numerically less important than the innumerable short-distance moves that completed the rural settlement of western Europe. By the beginning of 17th century, the great age of rural-rural migration in the west was ending.

It is difficult to estimate the importance of rural-urban migration in preindustrial Europe; even in the 18th century, the overwhelming majority of Europe's population lived in villages, hamlets, and small market towns, except in the Low Countries and England. Until the 19th century, rural birth rates generally exceeded urban birth rates, and urban death rates exceeded rural death rates; in most towns, and particularly in large ones, death rates exceeded birth rates. Thus, it is generally assumed that before the 19th century, towns could grow only by immigration from the countryside.

In 1000, Europe had no more than 100 places that could be called towns, and half of them were in ITALY; by 1300 there were 4,000 or 5,000 such places. The 12th and 13th centuries were a period of urban growth, standing in marked contrast to the preceding centuries. By 1300, Venice, Milan, and PARIS probably had 100,000 people each; LONDON 50,000. More important was the proliferation of small towns. In the 16th century, there were 500 market towns in England.

The 16th century saw not only a renewed growth of population but also rapid urban growth. The most striking feature of this period was the emergence of a number of very large cities. London grew from some 60,000 in 1520 to 250,000 in 1600 and had exceeded 500,000 by the end of the 17th century. Paris, the largest city in medieval western Europe, grew from 250,000 in 1600 to 500,000 in 1700, while Amsterdam, which had only 31,000 people in 1585, had reached 200,000 by 1650.

Epidemic death rates consistently exceeded birth rates in towns: 30,000 people died in 1580 in Paris from typhus; the plague caused 33,000 deaths in 1603, and 41,000 in 1625. Most of the migrants came to town from comparatively short distances away.

Rural-urban migration thus played an important role in reducing the rate of increase in the rural areas of preindustrial Europe. In most parts of Europe, there was little increase in urbanization before the 18th century, but the difference in the rates of natural increase between the town and country—it was negative in the former—ensured that some of the rural surplus was absorbed. It is likely that the rapid urban growth of this period was partially a function of the “push” from the countryside and not only the “pull” of the towns.

It is true that in the medieval and early modern periods, emigration overseas had no significant impact upon the countries of western Europe, but things drastically changed after the discovery of the Americas when considerable numbers did move. Some 100,000 Spaniards left for the New World in the 16th century. From 1620 to 1640 in England, 80,000 people left for IRELAND, the West Indies, and the North American colonies. By 1700, more than 500,000 people of English extraction were living outside England, compared with just over 5 million in England.

## THE ERA OF INDUSTRIALIZATION

After 1750, European countries experienced a pronounced increase in their total population size, so that by 1850 the population of most countries doubled, except in the case of Ireland and France, and increased rapidly for the rest of the century. In England, the century after 1750 saw the beginnings, and indeed the maturity, of industrialization.

But in the rest of Europe, industrialization did not get under way until later, and although there was urban growth, rural population increase was almost as rapid, so by the middle of the 19th century, the portion of population living in the rural areas had declined very little.

As a consequence, the countryside of rural Europe had to absorb a great increase in numbers before industrialization had made any progress. Thus, many parts of western Europe were suffering from rural overpopulation by the 1830s, and this was apparent in the growth of landlessness, the subdivision of farms, underemployment, and falling real wages. It was only in England that migration to the towns helped reduce the problems of the countryside before 1850, for it was only in England that industrial growth was rapid enough to absorb the rural surplus. Many European countries experienced remarkable population growth but without any significant industrialization. Undoubtedly, there was stress in the rural areas of these countries, and while there was some rural migration, the surplus rural population could not be absorbed in the towns. At this juncture, fortunately, there was an alternative open to the population: emigration to North America.

Many scholars have tended to emphasize the "pull" of North America as the major reason for the mass European migration of the 19th century, but until the 1870s the "push" element in the rural areas of western Europe must have been at least as important. In many parts of Europe, emigration was the only solution to rapid population growth. For example, in Norway the population doubled between 1800 and 1865. Nearly all this increase had to be absorbed in the rural sector. Migration was the only viable solution. The first emigrants left in 1825, but they were few until the 1860s, when a crop failure prompted the first mass migration from Norway in 1868 and 1869. By then, crossing the Atlantic was much cheaper, and the early emigrants had sent home good news and money. In SWEDEN, urbanization and industrial growth were more rapid after 1870 than in Norway, and the towns took more of the rural surplus.

Nonetheless, 1,105,000 emigrated between 1840 and 1914, the equivalent of 25 percent of the natural increase of this period. Irish emigration is often thought of as beginning with the famine, but it was already running at a high rate before 1845. The Irish population doubled between 1754 and 1821, and in the next 30 years there was acute subdivision of farms, an increase in landlessness, falling real wages, and an ever-increasing dependence on the potato crop. There was little industrial growth and the country remained overwhelmingly rural. In the absence of any internal outlet for the excess population, emigration was the only solution, and between 1780 and 1845, around 1,700,000 people left Ireland, one-third to Britain, the

rest to North America. The famine then merely accelerated the trend; between 1845 and 1851 about 1 million left, and in the following decade another million.

Since 1950, there has been movement out of developing countries, but on a very small scale. Thus, by the 1950s annual migration of Latin Americans into the UNITED STATES exceeded that of Europeans, and there has been a considerable flow of migrants from North Africa but not on a scale sufficient to reduce population pressure at home. In the 19th century, it was possible for some 40 percent of Norway's natural increase to be removed in 50 years, a total of 750,000. A movement of a comparable proportion of INDIA's natural increase between 1950 and 1970 would have involved over 70 million, approximately equal to the total number of emigrants from Europe since 1800.

Although international migration may have helped relieve population problems in some West Indian islands, and in the future may have similar localized effects elsewhere, there seems no prospect of overseas migration affording a solution to the population problem of densely populated developing countries.

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## military geography

FROM EARLIEST HISTORICAL writings, the nature of warfare is shown to be a struggle for positional advantage at the tactical, operational, and strategic levels. Xenophon writing of the fate of the 10,000 Greeks fighting in Persia in the 4th century B.C.E., tells of the constant consideration commanders gave to all aspects of the terrain and the disposition of resources as they fought their way homeward. River banks, hilltops, and forests gave advantage to groups of soldiers during tactical combat.

Mountains, deserts, and sea coasts gave advantage at the operational level as generals planned campaigns that spanned many miles. Cultural, economic, and political factors, all meshed with the dictates of the physical environment, combined to make up the concerns of military geography. Even earlier (5th century B.C.E.), Thucydides wrote of the consideration of these strategic factors of military geography as Sparta and Athens waged their great Peloponnesian war. It seems as long as mankind has maneuvered for positional advantage in a fight, geography has had military importance.

The two broad categories of consideration for the military geographer are the physical and the cultural aspects. Political leaders and their military commanders must deal with the realities of the physical and human worlds they strive in. To ignore the salient characteristics of the Earth and the people who live on it will imperil their military-political effectiveness, if not their existence.

Relative location and general spatial relationships are of primary concern. Distances dictate modes of

transportation, types of weapons, and communications requirements. Sequencing of events and objectives, prioritization of efforts, and assessments of vulnerability will be affected by questions of "how close" and "how big."

The characteristics of the ground topography will determine ease of movement, location of water obstacles, line-of-site for observation and engagement, and general protection from weapons' effects. The underlying geology and soil types will affect all manner of military engineering works dealing with mobility, fortification, and the effects of weather.

## WEATHER AND TERRAIN

Weather and climate have a direct effect on the operation of equipment, the level of physical work sustainable by troops, and the amounts of supply and fuel required. Ancient and modern history is replete with ill-advised military operations in the face of predictable weather patterns and known climate regimes. Armadas have been sunk, armies frozen, and air forces negated by the annual weather cycle.

The terrain and climate combine to create vegetation cover that again affects visibility, communication, and mobility. Most of these physical considerations continue across the coastal area into seas and waterways. Underlying geology has an impact according to water depth, while weather and climate remain cogent concerns.

The periods of illumination available from sunrise to sunset, along with moon rise and moon stage, are ever more critical with continuous and worldwide military operations. In the nonvisible areas of the electromagnetic spectrum, magnetic forces and radiations affect navigation and communications.

Human factors are of significant concern to the political and military planner, as they must consider the nature of their chosen enemy as well as the disposition and characteristics of all those who may be effected by the military operation and campaign. Linguistic requirements must be anticipated for the gathering of intelligence, control of refugees, and interface with populations, as well as communication with allies. Knowledge of cultural concerns of religion, holy sites, and historic sites is required for compliance with international law during military operations.

Long-term productive relationships with a liberated or conquered population must be built on a foundation of cultural understanding. Social mores and taboos must be considered during psychological operations. Cultural food habits will determine if rations



provided to affected populations and allies are acceptable or uneatable.

Land use patterns in rural areas, the nature of urbanization, the location and extent of industrialization, and transportation networks of a theater of operations are required knowledge for the military planner. Military forces are limited by these cultural factors as they seek to execute schemes of maneuver, develop logistical support, and maximize weapons' effects against opposing forces while mitigating damage to civilian populations and life support infrastructure.

### TACTICAL LEVEL

At the tactical level, military geography translates to the near considerations of terrain and vegetation, weather, and the cultural landscape. These military aspects of terrain are commonly known as observation and fields of fire, cover and concealment, obstacles, key terrain, and lastly, avenues of approach and mobility corridors.

Observation refers to the ability of a ground or near ground actor to see across the battle space unhindered by terrain relief or vegetation. The purpose of this observation is for surveillance and target acquisition. Typically this is done by line-of-sight optics or radar emitters. Observation and fields of fire go hand in hand as direct fire weapons follow line-of-sight trajectories. Intervening terrain or vegetation must be taken into account for the optimum operation of weapons, radios, radars, and lasers. The ability to see and shoot across the landscape is a primary consideration for situating of forces for both offense and defense. Line of sight works both ways.

Cover is protection from the effects of weapons. Masking terrain, defiles, and caves can provide some protection from the impact, blast, and fragmentation of direct and indirect fires. Concealment is protection from observation and can be afforded by terrain or vegetation. Concealment is a minimum requirement for secure military operations. Ideal combat positions are covered and concealed with good fields of fire.

Obstacles are any feature in the battle space that can slow, stop, or canalize military movement and maneuver. The obstacle can be natural, man-made, or a combination of both. The effects of weather can exacerbate the impact of obstacles.

Any point or area in the battle space that would provide a tactical advantage to the force that occupies it or controls it is considered key terrain. Of course the general scheme of maneuver, the precise disposition of forces, the scale of the operation, and enemy capabilities

will determine key terrain in each individual situation.

Avenues of approach are routes across the terrain that will allow a force to reach a desired objective. These avenues are evaluated in terms of their width, relative location to adjacent avenues of approach, cover and concealment, observation and fields of fire, and intervening obstacles. Mobility corridors are areas within the avenues of approach that bear specific characteristics best suited for specific types of mobility (for example, mounted, dismounted, or air). They are both further defined by the doctrinal movement rate and maneuver space for the size and type of military force anticipated.

All these aspects of terrain are modified by the weather. Some military aspects of weather are visibility (light data, fog, dust), winds aloft, precipitation, cloud cover, and temperature and humidity. These have the greatest effect on aviation, but also have direct effect on all military forces and their operations. Seasonal rains, temperatures, wind patterns, and general climatic conditions must be factored into every military plan.

### OPERATIONS OTHER THAN WAR

With the increased use of military forces in disaster relief, peacekeeping operations, and in many operations other than war, knowledge of the cultural factors of geography have grown in importance. Increased interaction with civilians in the battle space require not only that military strategic planners be cognizant of military geography, but also that individual soldiers and small unit leaders come to grips with cross-cultural issues.

In the broader view, military geography must include considerations of geostrategic issues, areas, and players. Disputes that inevitably involve military forces arise and fester along several boundaries. Man-made virtual boundaries of national frontiers have proven to be very contentious. These border disputes involve economic resources, ethnic populations, and pure territorial claims. Ethnic boundaries are found across the globe and bear the scars of war both ancient and recent. Resource boundaries emerge and fade as oil, fisheries, shipping lanes, and commerce ebb and flow. All these areas of cultural, economic, and political concern can rapidly move into the scope of military geography.

In 1996, the Association of American Geographers acknowledged military geography as a subfield of geography and defined it as the application of geographic information, tools, and techniques to solve military problems in peacetime or war.

The consideration of terrain, culture, politics, and economics in the pursuit of warfare will remain a dynamic field of geographic study and a practical area of military application.

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## Mindanao

MINDANAO, THE SECOND-largest island (36,537 square mi or 94,630 square km) in the Republic of the PHILIPPINES, is one of the three groups of over 7,100 islands in the country, the other two being LUZON and Visayas. The Mindanao group to the south consists of some 400 islands. The island Mindanao, about the size of INDIANA, occupies about a third of the Philippines's total area. Its highest point is on Mount Apo, which is 20 mi (32 km) to the west of Davao, often described as the world's largest city in terms of land area (943.5 square mi or 2,443.6 square km).

Mindanao lies in a zone of earthquakes and volcanic activity with an irregular, long winding coastline interspersed with numerous peninsulas, promontories, and bays some of which are very large and picturesque. As a tropical island, Mindanao has a mean annual temperature of 80 degrees F (27 degrees C) and a relative humidity of 77 percent. The rainy season stretches from May to November which is the summer monsoon, while the dry season lasts throughout December to April. Although much of Mindanao is sheltered by highlands, a typhoon is quite common during the peak rainy period (June to October). The average annual rainfall in the lowlands is about 80 in (203 cm).

Mindanao has a long history of political developments beginning with the arrival of Ferdinand MAGELLAN in 1521, which led to colonial rule in 1565. Spanish occupation lasted over three centuries until 1898, when SPAIN signed a treaty passing control of the

Philippines to the UNITED STATES. Two years after Japanese occupation (1942–44), the Philippines gained independence but inherited two major security threats from the communist-led Huk rebels in the north of Luzon and the Moro secessionist rebels in southern Mindanao. The Philippine army finally defeated the Huk rebels in 1954, but the Moro insurgency continued into the 1970s when President Ferdinand Marcos declared martial law in 1972, lasting until 1981, in an attempt to destroy the Moro National Liberation Front (MNLF) led by Nur Misuari. With material support from LIBYA the MNLF was able to sustain military campaigns against government troops demanding independence for areas under predominantly Muslim population.

In 1996, the government under President Fidel Ramos initiated a dialogue that led to the signing of a peace agreement providing for self-rule for Muslims in the southern Philippines. While the agreement ended three decades of rebellion that claimed over 120,000 lives, minor skirmishes are still faced by government security forces from two other groups outside the MNLF: the Moro Islamic Liberation Front (MILF) and the Abu Sayyaf. The latter group became notorious after a number of kidnapping incidents involving both local and foreign victims, including the well-publicized kidnapping of 21 foreign tourists on the island of Sipadan on April 23, 2000, and another episode involving six workers on an eco-farm resort in Lahad Datu, Sabah, on October 5, 2003. The long years of political turmoil have left Mindanao, especially the four MNLF-controlled southern provinces, with widespread disruption to the infrastructure, public services and the economy, causing the average income of the local population in the region to drop to less than half of the national average.

Mindanao, by virtue of its location in close proximity to MALAYSIA, BRUNEI, and INDONESIA, has become a natural focus of a growth triangle involving economic cooperation initiatives between the four bordering countries under a multilateral cooperative scheme called Brunei-Indonesia-Malaysia-Philippines East ASEAN Growth Area (BIMP-EAGA). The September 11, 2001, terrorist attacks on the United States brought more condemnation of the MILF, which is alleged to have close links to al Qaeda, thus weakening both domestic and international support for the long-drawn struggle of the Muslim rebel groups. For the non-Muslims and the moderate Muslim nationalists, this may bode well for the future of the island, which can begin to lay arms and start concentrating with greater resolve

on its neglected economic development programs based on the rich natural endowments of the region. Before the Marcos era, the region, with its fertile soils, abundant rainfall and sunshine, was one of the world's leading producers of several cash crops such as abaca (Manila hemp), sugar, and coconut. The region also produces banana, pineapple, coffee, pineapple, palm oil, and cotton for export, besides supplying the locally popular durian and flowers for the domestic market.

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## Minnesota

WITH THE EXCEPTION of ALASKA, Minnesota is the northernmost U.S. state, on account of the notch in its northern border, where Lake of the Woods abuts CANADA. Long known as the "Land of 10,000 Lakes," the state is also known for its progressive society, common Scandinavian heritage, sturdy agriculture, advanced technology, and outdoor tourism. Minnesota has a population of 5,019,720 (2002) and covers an area of 86,943 square mi (225,182 square km). Minnesota officially entered the Union in 1858.

The landscape of Minnesota was carved out by the glacial action of the last Ice Age. This glacial erosion left considerable areas of gently rolling hills. It also scooped out lowlands that filled with water, and melted ice, thereby creating the ubiquitous lakes of Minnesota. Depending on how size is used to define "lake," there actually are some 11,000–15,000 lakes in the state. The preponderance of water in the state is striking, especially in the north. When viewed from above in an airplane, the state can appear to be more water than land.

The glacial retreat of the ice age also deposited a thick layer of fertile soil across the lands of Minnesota. Combined with warm summers and typically ample rainfall (a humid continental climate classification),

Minnesota is blessed with an excellent agricultural setting. Minnesota is among the country's leading producers of corn, soybeans, livestock, and wheat. Many small towns and villages dot the landscape, acting as agricultural centers of activity amid a mixture of family farms. With a significant share of its land still forested, the state is a major producer of wood and forest products, with about 60,000 people employed in the industry. Historically, the timber industry was epic, featuring the folklore tales of Paul Bunyan and his blue ox Babe, statues of whom can be seen in the northern city of Bemidji.

The land also holds minerals. The Mesabi Range in northern Minnesota has for years produced a wealth of iron ore. Even as some of the richest veins of ore were emptied, extraction of lesser-grade ore (taconite) has continued. Residents of the Iron Range gained income directly and indirectly from the wealth brought in by the ore. Vast quantities of iron ore were shipped out of Duluth harbor, across Lake Superior, and on to steel mills in states such as PENNSYLVANIA. Even wind serves as a resource over the land, with high-tech windmills on wind farms in southwestern Minnesota.

The lakes and forests of Minnesota serve as magnets for tourism. Some 3 million people use Minnesota sites for recreation each year. Lakes provide thousands of settings for swimming, fishing, boating, and water skiing. Even in winter, recreational activity is prominent in the state; snowmobiling, ice fishing, and cross-country skiing are among the activities.

The eastern half of Minnesota's land was acquired from the British upon the American victory in the Revolutionary War. The vast LOUISIANA PURCHASE of 1803 included the western portion, with a small northern strip acquired from Britain in 1818. Numerous place names recall the original native presence in the region. Native American tribes were progressively pushed from their lands, eventually resettling in several reservations, mainly in northern areas. As in several states, some of these tribes built and currently manage gambling casinos.

Although Minnesota features a population of diverse origins, there is a clear imbalance in numbers toward those of Scandinavian origin. Migrants from NORWAY and SWEDEN came to the UNITED STATES in large numbers, particularly in the late 1800s and early 1900s. Their descendants are still there: Several Minnesota counties in the northwest have over 80 percent Norwegian heritage. Approximately half of the state's 5 million people reside in the broad Twin Cities (Minneapolis-St. Paul) metro area. While Minneapolis is the

larger of the paired cities, the state capital is St. Paul. A friendly rivalry exists between the two cities, as well as between “the Cities” and the out-state areas. Politically, the state has long displayed progressive tendencies and has sent forth prominent figures such as U.S. vice presidents Hubert Humphrey and Walter Mondale.

The Twin Cities also serve as the state’s economic core. Amid substantial manufacturing and service sector production, several national companies (General Mills, Honeywell, Northwest Airlines, Pillsbury, and 3M) base their headquarters there. The Mall of America in suburban Bloomington is the country’s largest indoor shopping center and attracts shoppers from great distances. An hour south of the Twin Cities, Rochester is dominated by the medical industry, featuring the internationally renowned Mayo Clinic.

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## Mississippi

**KNOWN AS THE** Magnolia State, Mississippi is bordered on the north by TENNESSEE, on the south by LOUISIANA and the Gulf of Mexico, on the east by ALABAMA, and on the west by LOUISIANA and ARKANSAS. The MISSISSIPPI RIVER, which flows along most of the western boundary of the state, is the origin of the state’s name. Legend says the Mississippi was named by the Chippewa Indians who called it “Father of Waters.” Mississippi is proud of its antebellum history, and the state retains many vestiges of the Old South, including well-preserved plantations and Civil War reenactments.

The total area of Mississippi is 48,434 square mi (1,225,443 square km). The state ranks 32nd in size and 31st in population among the 50 states. Mississippi’s largest cities are Jackson (the capital), Gulfport, Biloxi, Hattiesburg, Greenville, Meridian, Tupelo, Southaven, Vicksburg, and Pascagoula.

Approximately 1,520 square mi (3,936 km) of Mississippi are covered by water, and the coastline of the state runs 44 mi (113 square km) along the southern tip at the Gulf of Mexico. In addition to the Mississippi, the state’s major rivers are the Big Black, the Pearl, and the Yazoo. Major Mississippi lakes, many of which have been created by damming river waters, include Ross Barnett Reservoir, Arkabutla Lake, Sardis Lake, and Grenada Lake. Over time, the Mississippi River, in its meanderings, has changed course, creating a number of oxbow lakes, such as Eagle Lake on the Mississippi-Louisiana border. The average elevation of Mississippi is 300 ft (91 m) above sea level. The highest point in the state is Woodall Mountain, which is only 800 ft above sea level. The lowest point in Mississippi is at sea level where the land meets the Gulf of Mexico. The state is approximately 340 mi (547 km) from north to south and approximately 170 mi (273 km) east to west.

The climate of Mississippi is moist and semitropical and the state is subject to severe afternoon thunderstorms, particularly from June through November, with most thunderstorms occurring in July. Mississippi has long, hot summers and short, mild winters. The average temperature ranges from the just above freezing in the winter to the mid-90s degrees F (low-30s degrees C) in the summer. Annual precipitation ranges from 50 in (127 cm) in the northwestern section of the state to 65 in (165 cm) in the southeastern region. While northern Mississippi occasionally sees snow, the phenomenon is rare in the rest of the state. Occasional hurricanes assail the state.

The land of Mississippi varies greatly from the deltas along the banks of the Mississippi and Yazoo rivers to coastal terraces, piney woods, and prairies, to the flatlands of Mississippi’s highlands. Most of Mississippi falls within the East Gulf Coastal Plain, and the remaining area is encompassed within the Mississippi Alluvial Plain. In the East Gulf Coastal Plain, low hills predominate. The coastline of Mississippi is dotted by a number of large bays, including Bay Saint Louis, Biloxi, and Pascagoula. The relatively shallow Mississippi Sound divides the landmass from the Gulf of Mexico. The Mississippi Alluvial Plain, commonly referred to as the Delta, is relatively narrow but widens as it extends north toward Vicksburg. Much of the soil in the Delta has been enriched by the floodwaters of the Mississippi River.

Approximately 55 percent of Mississippi’s land is forested. Northern forests are covered with hardwoods such as elm, hickory, oak, cedar, short leaf pine, and tu-



pelo. Pines, such as loblolly longleaf, and slash, cover Mississippi's southern forests. Live oak, magnolia (the state tree), pecan, and sweet gum are found throughout the state. Flowering plants include magnolia (the state flower), azalea, black-eyed Susan, camellia, dogwood, iris, Cherokee rose, trillium, and violet. Large animals such as the white-tailed deer roam Mississippi's forests, which are also home to beaver, fox, opossum, rabbit, skunk, and squirrel. Mississippi is host to a number of songbirds, including the mockingbird (the state bird). The state has 29 state parks.

Until the beginning of the 20th century, Mississippi's economy was dominated by "King Cotton." After 1907, when the boll weevil destroyed cotton as the mainstay in many states of the Old South, Mississippi farmers turned to other crops such as soybeans. Agriculture continued to support the state's economy until the middle of the 20th century, when manufacturing gained an edge. Mississippi continues to be highly rural, with approximately 40 percent of the state covered by farms. Farmers in the area continue to grow cotton, which is again the state's largest cash crop.

By the beginning of the 21st century, only Texas farmers produced more cotton than those in Mississippi. The state also produces rice, hay, corn, peanuts, sugar cane, sweet potatoes, and wheat. Mississippi leads the United States in the production of upholstered furniture. Other income-producing industries include chemicals, plastics, foods, and wood. The economy of Mississippi is also dependent upon large deposits of petroleum and natural gas. Mississippi is the world's leading producer of pond-raised catfish, and the seafood industry flourishes in coastal areas. Legal gambling in Biloxi also supplements the state's income.

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## Mississippi River

MARK TWAIN begins the novel *Life on the Mississippi* by writing "The Mississippi is well worth reading

about. It is not a commonplace river, but on the contrary is in all ways remarkable." No better words can be used to summarize one of the world's largest, and North America's greatest, river.

The Mississippi River is born as little more than a trickle of water from Lake Itasca in the northwoods of MINNESOTA. It takes just nine small steps to cross, and is no more than ankle deep. From this beautiful but unimpressive brooklet grows the monstrous stream that drains the heart of a continent. The name *Mississippi* comes from the Chippewa (Ojibwa) word *Misipi*, which translates to "big water" or "great river." From Lake Itasca, derived from Latin meaning "the true head," the Mississippi River travels about 2,300 mi (3,705 km) to the Gulf of Mexico. Because the river's course is constantly changing, its exact length is hard to accurately know. Different sources will inevitably offer many different numbers.

The length has been stated as long as 2,552 mi (4,107 km). When combined with the Missouri River, the longest tributary of the Mississippi, the river system is the fourth longest in the world, behind only the NILE, AMAZON, and CHANGJIANG (YANGZI) rivers. Along the route, the river falls 1,475 ft (450 m), nearly half of which is lost before the river reaches Minneapolis, Minnesota.

Depth also varies along the river. The U.S. Army Corps of Engineers keeps a navigation channel of at least 9 ft (3 m) to the end of navigable water at Minneapolis for cargo vessels. However, the river is much deeper than that in its lower reaches. Near New Orleans, LOUISIANA, the river is not as wide as it is farther upstream but carries more water. This is possible because of the increased depth there. Off Algiers Point in New Orleans, the river reaches 200 ft (61 m) in depth.

Water volume increases steadily as the river flows south. In the upper reaches, tributaries like the Minnesota, Chippewa, and Wisconsin rivers join. The largest jump in volume occurs in the middle reaches, where the two largest tributaries, the Missouri and Ohio rivers, combine with the Mississippi. In the lower reaches, the Mississippi gets a boost from rivers like the Arkansas, Yazoo, and Red. The Mississippi River ranks fifth in the world in average discharge.

The Missouri and Ohio rivers add the most volume, and contribute to flooding more than any other tributaries. The Missouri River drains an enormous area. Its coverage stretches from southern CANADA to the middle of KANSAS, and as far west as IDAHO. Its major tributaries include the Yellowstone, Platte, and Kansas rivers. The Ohio is also impressive; though not



*The length of the Mississippi River has been stated as long as 2,552 mi (4,107 km). When combined with the Missouri River, the longest tributary of the Mississippi, the river system is the fourth-longest in the world.*

as long as the Missouri, its drainage receives more annual precipitation. Its major tributaries are the Allegheny, Kanawha, Cumberland, and Tennessee rivers.

Water from Lake Itasca will travel through or along 10 U.S. states, reaching the Gulf of Mexico in about 90 days. The average speed of the river near the headwaters is around 1.2 mi (1.9 km) per hour. In the lower reaches the speed can exceed 3 mi per hour (4.8 km per hour). It could be said that the river travels about as fast a person walks.

### MISSISSIPPI WATERSHED

The watershed of the Mississippi River is the second largest in the world. It drains an area of over 1.25 million square mi (4.76 million square km). The watershed reaches from the Allegheny Mountains in the east to the ROCKY MOUNTAINS in the west. This area makes up 41 percent of the United States, including all or some of 31 states and two Canadian provinces, Manitoba and Saskatchewan. The river drains one-eighth of North America.

Europeans did not discover the Mississippi River until 1541. In that year, Hernando De Soto came upon the river south of present-day Memphis, TENNESSEE. He arrived there after traveling overland from the Gulf Coast of FLORIDA in search of El Dorado and the Seven Golden Cities of Cibola. De Soto died of fever within a year of the discovery and was buried in the river. Interest in the Mississippi River by Europeans would not rise again for over 100 years. Upon hearing rumors of a great river, and in need of water routes, the French sent two men from the Great Lakes to explore the river in 1673, Louis Jolliet and Jacques Marquette. The men found the river and traveled on it south as far as the confluence of the Arkansas River. Sieur de La Salle later claimed the river for FRANCE in 1682.

Development along the river was slow to come after its discovery. Natchez (in present-day Mississippi) was founded in 1716, and was closely followed by New Orleans, Louisiana, in 1718. The LOUISIANA PURCHASE occurred in 1803, opening western lands and bringing settlers to the river. Fertile agricultural lands

and the discovery of minerals such as lead attracted many. The steamship was invented in 1807, making upstream travel feasible, and commerce increased rapidly. Today, nearly 300 million tons (272 billion kg) are shipped on the river annually.

In 1861, the river gained strategic importance. As the Civil War began, the Mississippi was vital to the Union's war plan. If the river could be controlled, the Confederacy would be split in two. Thomas Jefferson once said, "He who possesses the Mississippi possesses power." The Union also thought so, and General Ulysses S. Grant captured Vicksburg, Mississippi, on July 4, 1863, opening the river and taking a large step toward Union victory.

### MISSISSIPPI FLOODS

There are still a few battles being fought on the Mississippi River. One is being fought by the U.S. Army Corps of Engineers against the river itself. Large floods are very destructive to agriculture, property, and human life. The first levee built to hold back floodwaters was constructed in 1717. It was 3 ft (1 m) high and stretched just over 1 mi (1.6 km) to protect New Orleans. The Mississippi River Commission (MRC) was created in 1879 to improve the river for navigation and to control flooding. Engineer James B. Eads designed and constructed jetties at the river's mouth to make the Mississippi deepen its own channel. The levee system was expanded and its height increased. In 1882, the Mississippi flexed its muscle and spilled over the levees and compromised them in 284 places, proving their ineffectiveness. The MRC decided the system needed rapid expansion after a similar flood in 1890.

Flooding continued after expansion. Floods occurred in 1897, 1903, 1912, 1913, 1922, and in 1927 the largest flood to date created 226 levee breaks and inundated an estimated 11 million acres (4.4 million hectares); 246 people died and damages may have been as high as \$400 million. It was decided again to increase the size of the levees and create floodways to funnel water. Floods followed in 1937, 1973, and the most destructive Mississippi flood occurred in 1993. Levees have been shown to increase the magnitude of flooding while decreasing their frequency.

Today, locks and dams have been constructed between St. Louis and Minneapolis to aid navigation, 29 in all. In 1963, the Old River structure was completed in Louisiana to keep the Atchafalaya River from capturing the Mississippi and rerouting it away from New Orleans. The Atchafalaya Basin offers a steep, short route to the Gulf of Mexico, which the Mississippi will

take if allowed. Flood control is being reevaluated and the river is being allowed to reclaim some of its floodplain to reduce the extent of flooding. Flood control measures have come under heavy fire from the public because of continued flooding, and by environmental lobbies because of the presence of endangered species and the interruption of natural systems.

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## Missouri

IN THE MIDWESTERN UNITED STATES, Missouri is the 19th state in terms of size of all the states. Its name is derived from a Native American word for "town of large canoes." Missouri covers an area of 69,686 square mi (180,487 square km). A LANDLOCKED STATE, inland waters cover an area of 691 square mi (1,790 square km). The largest of these waters is Lake of the Ozarks in central Missouri. The state's north-south extent is 308 mi (496 km) and the east-west extent is 284 mi (457 km). With the MISSISSIPPI RIVER running along its eastern border, Missouri is bounded by eight states: IOWA, ILLINOIS, ARKANSAS, KANSAS, KENTUCKY, TENNESSEE, OKLAHOMA, and NEBRASKA.

Missouri, thanks in part to a lack of major physical features, has a continental climate with hot and humid summers coupled with cold winters. The average July temperature is 78 degrees F (26 degrees C), and the average January temperature is 31 degrees F (-1 degrees C). Missouri sees an average of 40 in (102 cm) of precipitation a year, the bulk of it falling in the south. The

lack of features also creates space for contrasting air masses to meet, causing summer storms or tornadoes.

### MISSOURI REGIONS

Missouri has several specific regions, all similar in their moist soil. In the north, the Dissected Till Plains run north of the Missouri River. This area is characterized by rolling hills and fertile plains with red soil. Very similar in the west are the Osage Plains, with slightly lower hills and less fertile soil. The Ozark Plateau covers most of the south. This is the largest physical area in Missouri and contains the state's highest point, Taum Sauk Mountain, at 1,722 ft (518 m).

In the southeast corner of the state are the lowlands, and the most fertile region, as the soil is nourished by the Mississippi River. The Mississippi has been both a blessing, in terms of navigation and agriculture, and a curse, as river flooding can be extensive and economically ruinous (the 1993 flood was particularly disastrous).

Missouri's forests, covering a little over a quarter of the state, are almost all located in the south. In the mid-southwest of the Ozark region are hickory and oak trees, while in the plains bald cypress and sweet gum are prevalent. Most of the wildflowers are found in the alluvial plains of the Mississippi, with milkweed, sweet William, mistletoe, and hawthorn widespread. Missouri is home to many common mammals, such as deer (the most prevalent), bears, rabbits, squirrels, minks, and muskrats. Common songbirds such as blue jays, cardinals, woodpeckers, and finches are all residents of Missouri, along with game birds like turkeys and quail.

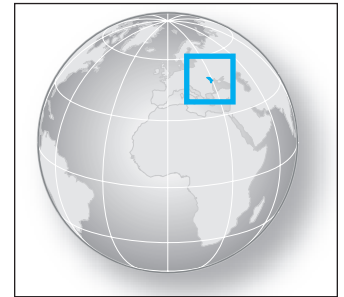
Missouri was first explored by Native Americans, as much as 4,000 years ago, but was officially discovered by Jacques Marquette in 1673. Missouri, part of the LOUISIANA PURCHASE, became a U.S. territory in 1803, and a U.S. state 18 years later in 1821. Despite it being a slave state, Missouri was on the Union side during the Civil War. Though Jefferson City is the state capital, Missouri's St. Louis became the gateway to the west during the westward expansion and gold rush eras.

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## Moldova

**Map Page** 1132 **Area** 13,067 square mi (33,843 square km) **Population** 4,439,502 **Capital** Chisinau **Highest Point** 1,419 ft (430 m) **Lowest Point** 6.6 ft (2 m) **GDP per capita** \$2,500 **Primary Natural Resources** lignite, phosphorites, gypsum.



THE REPUBLIC OF MOLDOVA is the second-smallest former Soviet republic and the most densely populated, located in the borderlands between the UKRAINE and ROMANIA, to which it is linked ethnically and linguistically. It is actually only half of the area traditionally known as Moldavia; the western portion has been an integral part of ROMANIA since its independence from the Ottoman Turks in 1878.

The eastern portion, known as Bessarabia, lies between the rivers Prut and Nistru (Dniester in Russian) and has been passed back and forth among the Ottomans, RUSSIA, and Romania several times since the early 19th century. Independent since the breakup of the Soviet Union in 1991, many Moldovans wish for full union with their kindred in Romania, but this move has been blocked by Russians and by Romanians, who do not wish to antagonize their much larger neighbor. One of the reasons for this is the large number of Russians who live in Moldovan territory, on the eastern banks of the Dniester.

This region has proclaimed its independence from Moldova as the "Republic of Trans-Dniestria" (called Stinga Nistrului in Moldovan), and although it is de facto an autonomous state (with its own government and currency), no other nation recognizes its sovereignty, not even Russia, whose troops remain to "protect the peace" (after a short but bloody civil war in 1992). Moldova's boundaries also enclose another region that has been given extensive autonomy (in 1994), albeit much more peaceably, Gagauzia, home to a people who speak a Turkic language but converted to Orthodox Christianity centuries ago.

Moldova is LANDLOCKED, but only by a thin strip of land belonging to Ukraine (south of Odessa) that separates it from the BLACK SEA. Access to the sea is gained through the lower reaches of the Dniester and Moldova's tiny stretch of the DANUBE (0.4 mi or 0.7 km) at its confluence with the river Prut before it enters its broad DELTA. The Dniester River dominates the east-



ern portion of the country, at points forming the boundary with Ukraine. A major feature along this river is the 60-mi or 97-km lake, Dubossary, formed by a large hydroelectric dam built in the 1970s. Other Soviet hydrological projects included a plan to divert much of the water from the Dniester across southern Ukraine to the Dnieper and Bug rivers, but this was never constructed. Two medium-sized tributaries flow into the Dniester, the Reut and the Byk. The Byk flows past the capital, Chisinau (formerly Kishinev), which, although relatively small, was the third-fastest-growing city in the Soviet Union in the 1980s.

One of the poorest states in Europe, Moldova has nevertheless made economic progress through rapid privatization. One of the former Soviet Union's agricultural heartlands, Moldova's broad and fertile plains contain an abundance of rich farmland, but very few mineral resources, so the region remains reliant on Russia for oil, coal, and natural gas. The terrain is slightly hillier in the north, the start of low foothills descending from the Carpathian Mountains to the northwest, where the Prut and Dniester have their sources. The country's topography then declines in a gradual slope toward the Black Sea.

The climate is mostly temperate but becomes warmer and almost Mediterranean in the far south, allowing for cultivation of Moldova's most significant agricultural product, wine, which used to supply as much as one-third of the total wine sales in the Soviet Union. Much of this industry is concentrated in the autonomous Gagauzia region, in its capital, Comrat. Tobacco is also a major export crop, supplying the material for cigarettes for most of Eastern Europe and Russia. The rich black soil of the country's rolling plains (*chernozem* in Russian, among the most fertile soil in the world) are a great resource for potential growth.

The southernmost part of Moldova is the westernmost portion of the STEPPE that extends across southern Ukraine toward Central Asia. The land here is much drier but well-irrigated and easy to cultivate. The richness of this soil and the most favorable climate in the whole of the former Soviet Union (similar to the Crimea), have lured settlers and conquerors throughout history, one of the reasons Moldova is experiencing its independence for the first time.

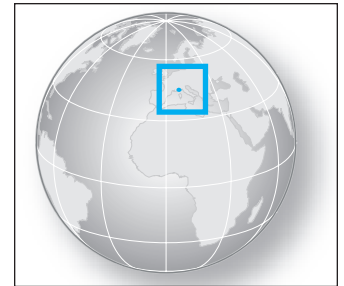
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## Monaco

**Map Page** 1131 **Area** .75 square mi (1.95 square km)  
**Population** 32,130 **Capital** Monaco-Ville **Highest Point** Mount Agle 460 ft (140 m)  
**Lowest Point** 0 m **GDP per capita** \$27,000 **Primary Natural Resources** climate for tourism.



WHILE EXTREMELY SMALL at only 48 acres (19.4 hectares) in area bordering FRANCE and ITALY, Monaco still has several distinct geographic areas. The official residence of the government and prince of Monaco is a rocky point called Monaco-Ville. The Monte Carlo district, with its famous casino and expensive boutiques, is at the opposite end of the principality. Between the Rock and Monte Carlo is the small harbor and shopping area known as La Condamine. Fontvieille is a new residential area reclaimed from the sea. It has



Monte Carlo Bay in Monaco on the Mediterranean Sea is famous as a haven for the wealthy.

a large marina as well as a sports stadium and some small light industry.

Monaco remains one of the few officially royal countries in the world. Its leaders are hereditary, descending from the founder of Monaco, François Grimaldi, who sneaked into the original castle disguised as a monk on January 8, 1297. Since then the Grimaldi family has been the recognized rulers of Monaco. Should the family die out, Monaco will become an autonomous district of France. It was recognized by the United Nations in 1993.

Monaco's primary economic value today is as a major tourist and banking center as well as a tax haven for the very wealthy. There is no income tax paid in Monaco. Its political neutrality has been recognized virtually since its inception. Often overlooked is Monaco's world-class Oceanographic Museum, founded by Prince Albert I in 1906. It is one of the most prominent centers for marine studies in the world and may be best known for its association with Jacques Cousteau.

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## Mongolia

**Map Page** 1120 **Area** 604,250 square mi (1,565,000 square km) **Population** 2,712,315 **Capital** Ulaanbaatar **Highest Point** 14,350 ft (4,374 m) **Lowest Point** 1,699 ft (518 m) **GDP per capita** \$1,840 **Primary Natural Resources** oil, coal, copper, tin, nickel.



ONCE ONE OF THE world's largest empires (under Genghis Khan), Mongolia eventually became a territory of CHINA, then was dominated by the former Soviet Union. LANDLOCKED (bordered by China and RUSSIA) and often considered to be all DESERT, Mongolia, in fact, contains numerous mountains, forests, and lakes. Only its southern margins bordering on China

are drylands and deserts. However, even these support sparse grasses and nomadic herders.

Mongolia can be divided into a series of north-south and east-west grids. Generally, the northern third of the country is mountainous and forest-covered and has several large lakes. Its natural features include the Henti and Hangai mountains and lakes Hovsgol and Ulaangom. The north also is the most economically developed and urbanized segment of the country. The middle section is a STEPPE or GRASSLAND mixed with forests. Desert and grasslands are in the south. Here are concentrated the major herding areas and the nomadic population that emphasizes raising a combination of camels, goats, sheep and horses. It also is the area most susceptible to massive herd losses from winter blizzards known as *dzud*. Fortunately, animals are a renewable resource.

### GRASSES AND DESERTS

The southernmost section is dominated by sparse grasses and hard desert surfaces. And, as with most deserts, it also is scoured by often tornadic winds and sandstorms. This is the area where the famous dinosaur remains have been concentrated; the first discovery of dinosaur eggs in 1923 was during an expedition led by the scientist Roy Chapman Andrews.

Along the axis of an east-west grid, eastern Mongolia is generally a moist and rich grassland. It also has recently been the site of oil and natural gas development. Its closest economic link is with northeast China (the former Manchuria). The western third is dominated by the Altai Mountains and its basins. The population here generally has large numbers of nomadic Kazakhs.

There are a number of large inland lakes, such as Ulaangom, that are important wildlife (migratory waterfowl) refuges. The central core area is the most urban. It is dominated by the only rail line in Mongolia. This line links Mongolia with the rest of the world via transit through either China (the shortest route) or Irkutsk in the Russian Federation.

Today, Mongolia is a republic with democratic elections and an elected parliament (Hural). An interesting part of Mongolia's culture is that women have full suffrage, serve in the Hural, and have always had full equality with men, even in the time of Khan.

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## monsoon

THE HEAVY RAINS of the monsoon appear in June and subside in September every year in the Northern Hemisphere. Meteorologists and scientists are greatly helped by the development of sophisticated weather analysis and forecasting technology in understanding monsoon mechanisms. Numerous people on the earth are affected by this significant climatic system. The monsoon directly governs the destiny of cultivators in South, East and Southeast Asia, as farming is heavily dependent on the seasonal rains. The summer monsoon winds bring heavy showers over most of South Asia.

An improved understanding of monsoons has embraced the majority of the phenomena connected with the weather system in the tropical and subtropical part of the Asian, Australian, and African continents and the neighboring water bodies. ARIZONA, NEW MEXICO, UTAH, and COLORADO in North America are also affected by monsoons in late summer.

A monsoon-type of climate is associated with wet summers and dry winters. The word *monsoon* seems to be derived from the Arabic word *mausim*, meaning "seasons." It is recurrently misused as a synonym for "heavy rainfall," though the misnomer is justified. Ancient merchants used the word to explain a system of seasonal reversal of wind while sailing over the INDIAN OCEAN and adjacent Arabian Sea. Their direction of sailing movement was governed by these seasonal winds. The winds gust steadily from the southwest during one half of the year (summer) and from the northeast during the other (winter). Thus, *monsoon* has been defined by climatologists as a large scale wind system that predominates or strongly influences the climate of large regions, and in which the direction of the wind flow reverses from winter to summer.

Three essential mechanisms are involved in causing monsoons: 1) differential heating and cooling of land and water, as land absorbs/releases heat faster than the water; 2) deflection of wind in response to the Coriolis

effect, caused by the rotation of the Earth; and 3) latent heat exchange—the exchange of energy involved while changing the state of water from liquid to vapor and back.

The most renowned of the entire monsoon is the Asian monsoon, which is truly a seasonal, cyclic climate. To understand the causes for the seasonality, certain dynamics need to be analyzed. During the summer, the sun is vertically over the Asian continent. The Central Asian landmass gets intensely heated, resulting in expansion and ascension of air above the surface, creating a low-pressure area over Central Asia. Alongside it, the INDIAN OCEAN watermass remains relatively cooler, making a high-pressure region.

The variation in temperature between landmass and water could be much as 68 degrees F (20 degrees C). Such differential heating and cooling causes the moisture-laden air from the Indian Ocean to move toward South and Southeast Asia. This occurs because wind essentially moves from high pressure to low pressure regions. As the wind is deflected toward the right in the Northern Hemisphere (Coriolis effect), these winds become southwest monsoons. During the fall, landmass and water begin to cool and the land starts losing heat faster than the ocean.

Therefore, in the winter, the pressure system reverses because the cold polar airmass moves southward, and Tibet and the surrounding areas in the north become a high-pressure center. The Indian Ocean, over which the sun rays fall directly, turns into a low-pressure zone. Thus, the wind direction is reversed, becoming the northeast trade winds of the winter.

Another important factor that directs the commencement or disappearance of summer monsoons in Asia is the situation of the upper-level JET STREAMS. These are a "meandering belt of strong winds in the upper atmosphere," as explained in *Introduction to Geography* by Arthur Getis et al.

When a lofty mountain system like the HIMALAYAS lies in its path, the westerly jet streams divide into two branches (south and north of the Himalayas). These two branches prevail from November through April. The disappearance of the jet streams south of the Himalayas in November causes the sudden "retreat" of monsoon rains from Asia. During the months of July and August, there is an easterly jet stream prevailing over the Indian peninsula.

The southwest winds produce most of the rainfall over the entire Indian subcontinent. These winds, however, ignore Rajasthan or the THAR DESERT of INDIA and western PAKISTAN because they are deflected by the



earth's rotation (Coriolis effect) toward the northeast, and, therefore, the northwestern part of the subcontinent remains relatively dry. There are only 20 rainy days in Kutch (India), and some places in the Rajasthan desert have fewer than five rainy days in a year. Nevertheless, a large part of India, BANGLADESH, and Pakistan receive protracted heavy rains and associated flooding.

The monsoon provides valuable and abundant water to Asia. Most of the monsoon climatic region that encompasses South, East, and Southeast Asia supports agrarian economies dependent on rainfall. Consequently, the route of the monsoon winds decides the fate of the region. Deviation of the monsoon from its normal pattern disturbs agriculture operations, which can become disastrous for rain-dependent agrarian economies.

Unfortunately, the pattern, distribution, amounts, and magnitude of rainfall vary considerably each year. The variability can lead to severe drought and floods that can significantly amplify the price or reduce the availability of food. Immense deviation from the normal pattern might ultimately lead to famine. Correct forecasting of the onset of the monsoon has become absolutely indispensable. Computer models of monsoons are intricate and need to be precise; helping to alleviate the implication of a weak monsoon.

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## Montana

AS THE TREASURE STATE, Montana is known for its mountains and extensive natural resources, such as copper, silver, gold, coal, lead, zinc, oil, limestone, antimony, phosphates, and gypsum. This mountain state encompasses 147,046 square mi (380,821 square km) of land area; Montana is the fourth largest state in the UNITED STATES, but it is 44th in population, partly because parts on the state are virtually inaccessible. The state is approximately 630 mi (1,014 km) east to west

and 280 mi (450 km) north to south. Montana is bounded on the north by CANADA, on the south by IDAHO and WYOMING, on the west by Idaho, and on the east by NORTH DAKOTA and SOUTH DAKOTA. The ROCKY MOUNTAINS cover the western third of the state. The other two-thirds of Montana are covered with gently rolling hills. Montana, which became a territory in 1864, was admitted to the Union in 1889 as the 41st state. Yellowstone National Park, which covers 2,219,791 acres (898,317 hectares), brings approximately 3 million visitors a year to Montana. In addition to the capital city of Helena, Montana's largest cities are Billings, Missoula, Great Falls, Battle, Silver Bow, Bozeman, Kalispell, Havre, Anaconda-Deer Lodge County, and Miles City.

The highest point in the state is 12,799 ft (3,901 m) above sea level at Granite Peak. The lowest point in Montana is 1,800 ft (548 m) above sea level at the Kootenai River. Geographically, the eastern three-fifths of Montana falls within the Great Plains, while the remaining two-fifths of the state are part of the Rocky Mountain region. As part of the Interior Plain of North America that runs from Canada to MEXICO, Montana's Great Plains section is covered with gently rolling land interspersed with hills and river valleys. Bear Paws, Big Snowy, Judith, and Little Rocky Mountains are found within this area. In the southeastern section, Montana's badlands are dominated by red, yellow, brown stone formations.

The western area of Montana is dominated by mountains, flat grass-covered valleys, and fir, spruce, and pine forests. Valleys in this region may spread out for as much as 40 mi (64 km). Some 50 mountain ranges are located in the Rocky Mountain region, including the Absaroka, Beartooth, Beaverhead, Big Belt, Bitterroot, Bridger, Cabinet, Crazy, Flathead, Gallatin, Little Belt, Madison, Mission, Swan, and Tobacco Root. Soils in the mountains tend to be poor and thin, unlike the more fertile areas of the plains. Grama, buffalo, and bluestem grasses are common in Montana.

### MONTANA CLIMATE

The Continental Divide separates Montana into two distinct climates. Eastern Montana has a cold, continental climate. The temperature in the west is modified North Pacific maritime. Montana mountains may be covered with snow for as much as eight or ten months a year, and the Great Plains area is beset with freezing arctic air several times each winter. The average temperature in the state ranges from 70 degrees F (21 degrees C) in the summer to 8 degrees F (-13 degrees C)



in the winter. While western Montana may receive as much as 43 in (109 cm) of rain annually, the eastern section receives less than 20 in (51 cm) per year. Earthquakes are not uncommon along the fault lines that lie within the Rocky Mountain region.

Among the 50 states, Montana is the only state that has rivers draining into the Gulf of Mexico, the Hudson Bay, and the PACIFIC OCEAN. Montana's major rivers are the Clark Fork River, the Missouri, and the Yellowstone. The state's major lakes are Lake Flathead and Fort Peck. At the highest levels of the states, glacial drift may still be found.

Agriculturally, grain is Montana's major crop. Wheat, barley, rye, oats, hay, flaxseed, sugar beets, potatoes, and livestock bring in substantial revenue for the state. Other revenue evolves from mining, the tourist trade, dude ranching, hunting, fishing, and skiing. Timber is also a major industry for Montana because two-thirds of the state's forests are suitable for commercial use. The most valuable timbers are western yellow pine, Douglas fir, larch western white pine, and spruce. In addition to timber, Montana's major manufacturing industries deal with food products, wool, and printing and publishing.

Mountain goat, bighorn sheep, elk, moose, mule deer, white-tailed deer, grizzly bear, black bear, mountain lion, and fox frequent Montana's mountains. Other areas provide homes for mule deer, pronghorn antelope, coyote, and various game and waterfowl.

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## Montserrat

THE ISLAND OF Montserrat, an overseas territory of the UNITED KINGDOM, is part of the chain of islands in the CARIBBEAN SEA that were formed millions of years ago by volcanoes, some of which remain active, while others are completely dormant. Montserrat itself is

composed of seven active volcanoes of varying ages, which have been mostly inactive since the time of the island's colonization in the 1630s. But in July 1995, the Soufriere Hills began to emit hot ash and gases, forcing over two-thirds of the population from their homes and the abandonment of nearly half the island.

Like its neighbors to the north, ANTIGUA AND BARBUDA, and SAINT KITTS AND NEVIS, Montserrat was colonized by the British mostly for its potential for raising sugarcane. Its neighbor to the south is the French overseas department of GUADELOUPE. These islands also are volcanic in origin, and the Soufriere de Guadeloupe is an active volcano. Nevertheless, there had been little sign of imminent danger on Montserrat, and no emergency plans had been laid. Some evidence indicates that the island saw its last eruption about 18,000 to 19,000 years ago, but other evidence suggests it could have been as recent as the early 17th century, just before colonization. Indeed, the name of the most recently active area is the Soufriere Hills, named for the French term *soufrière*, a vent or fumarole that emits sulfurous gases and vapors (the French word itself is related to the English word *sulfur*).

### CONTINUING ERUPTION

Certain recent seismographical readings indicated a rise in activity beneath the island, still the island was unprepared for the slow but steady eruption starting in July 1995, which has continued ever since. By August 1995, the capital, Plymouth, and all of the villages in the southwest and east were evacuated. Volcanic activity began with pyroclastic flows—mixtures of hot ash, boulders, and gases—followed by more serious explosions beginning in September 1996. In June 1998, the British government unveiled an aid package, but about half of the island will be uninhabitable for a decade.

Before the eruption, the island was relatively quiet. With a pleasant tropical climate and only a narrow coastal lowland, tourism was a mainstay, followed by production of rum, textiles, and electronic appliances. The future remains uncertain, with most of the population living in temporary quarters or off the island altogether. Scientists from around the world continue to monitor the situation at the new Montserrat Volcano Observatory, hoping to learn all they can from this occurrence to better protect against similar disasters in the future.

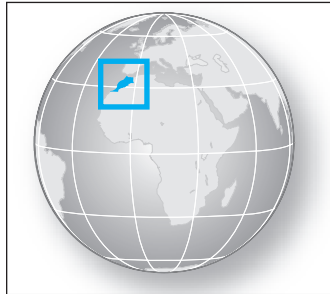
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## Morocco

**Map Page** 1113 **Area** 172,413 square mi (446,550 square km) **Population** 31,167,783 **Capital** Rabat **Highest Point** 13,665 ft (4,165 m) **Lowest Point** -180 ft (-55 m) **GDP per capita** \$3,700 **Primary Natural Resources** agriculture, phosphate mining, minerals.



MOROCCO REPRESENTS the finest example of multicultural fusion, combining 2,000 years of languages, rituals and customs, cuisine and foods, and religions into one colorful and productive blend called Al Maghreb. Once hosting vital Roman outposts at the pastoral Volubilis and coastal Lixus, Morocco has seen North African, European, and Asian allies, marauders, and colonizers come and go. However, it has always emerged enriched, and maybe that is why Morocco has developed a culturally embedded sense of acceptance along with its native Berber roots of hospitality.

Located on the western edge of North Africa and situated on both the MEDITERRANEAN SEA and ATLANTIC OCEAN, Morocco shares borders with the countries of ALGERIA and WESTERN SAHARA. Slightly larger than the state of CALIFORNIA, Morocco's long coastlines and mountainous spines afford it varied climatic regimes and agricultural production. The country is dominated by a number of ranges, including the Rif, Middle, High and Anti-ATLAS MOUNTAINS. Towering above the plains of Marrakech lies Mount or Jebel Toubkal with its often cloud-hidden peak of some 13,000 ft (3,000 m) above sea level.

Morocco's change in relief from sea level to its high peaks produces a wide assortment of fruits, nuts, vegetables, and livestock—adding to Morocco's famous cuisine. Integrated Berber, Arab, French, and Spanish residents have all helped create a culture like no other. Crisp and succulent baked pigeon pies, stews of lamb and prunes, and chicken with raisins have elevated

Moroccan cuisine to among the most favored and sought in the world.

From the calm blue Mediterranean Sea to the rough, grey Atlantic Ocean, Morocco's coastal plains support thriving farms and orchards, urban and industrial centers, and its primary highways and roads. And although the Atlas Mountains separate the coastal plains from the broad SAHARA DESERT and prevent easy access to either side, these impressive plains, peaks, coasts, and valleys have helped create the unique character of Morocco.

The Kingdom of Morocco was a French protectorate from 1912 to 1956, when Sultan Mohamed became the king. From the house of Alawi and a direct descendant of Muhammad, the Prophet of Islam, the sultan was succeeded in 1961 by his son Hassan, who ruled for 38 years. King (or *Malak*) Hassan, a popular ruler and clever statesman, played a major role in the Palestine-Israel peace process, since many of the earliest immigrants to Israel came from Morocco. In 1976, Hassan inspired thousands of Moroccans, with green-bound Qur'ans in hand, to march into the nation of WESTERN SAHARA to the south, demanding annexation to Morocco. This "Green March" fomented the occupation of Western Sahara, whose status and boundaries are still unresolved.

While the whole of Morocco mourned the death of their leader King Hassan in 1999, his son ascended to the throne to become King Mohammed VI. Following his father's death, King Mohammed declared his support of the constitutional monarchy, a successful political plurality, a moderate economy, and a new thrust to alleviate poverty and unemployment throughout the kingdom. He has proved himself to be opposed to Islamic radicals and has supported private media and the freedom of speech. However, in 2003, the French organization Reporters sans Frontieres condemned Morocco for its "regular interference" in media censorship by the kingdom's intelligence services. Increasingly, self-censorship within media organizations is widespread.

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## Moscow

MOSCOW IS THE capital city of the Russian Federation, and although superseded as the official capital during the 18th and 19th centuries, it has dominated Russian politics, culture, and economics since the 14th century. Today, it is RUSSIA's largest city and one of the largest urban centers in Europe.

Geographically, Moscow lies at the center of European Russia, the center of the East European Plain. It lies on both sides of the Moscow River, a tributary of the much larger VOLGA, a short distance to the east. The Moscow Region is slightly hilly, wooded STEPPE. The climate is cool: Moderate temperatures in the short summer and bitterly cold in the long, dark winter, when temperatures generally are in the mid-teens F (-8 or -9 degrees C), but occasionally as low as -44 degrees F (-42 degrees C). The city itself is roughly circular, having been built in concentric waves out from the Kremlin, the city's physical and administrative heart. Most major roads in Moscow either circle or radiate from the Kremlin.

The city's boundary corresponds to the outer ring road situated 10 to 13 mi (17 to 21 km) from the city center, encompassing roughly 350 square mi (900 square km). Much of Russia's highway and railroad network radiate from this central point for thousands of miles in every direction. Since the 1930s, Moscow has been a port as well, with the Moscow Canal linking the city to the Volga and its vast internal waterway network connecting the BLACK SEA to the Baltic. Even during the period when Russia's Imperial capital was in SAINT PETERSBURG (1712–1918), Moscow's location at the center of the empire led to its development as Russia's center for industry, as well as a focus for the nation's emerging scientific and artistic communities. Today, Moscow is home to the Academy of Science and numerous colleges and universities, Russia's two main newspapers, and some of the most famous theaters and art galleries in the world, including the Bolshoi Theatre and the Tretyakov Gallery.

Moscow appeared first as a small village in the mid-12th century, strategically located at the center of TRADE ROUTES between the Volga River system and the rivers of the south and west. In 1156, a Russian prince, Yury Dolgoruky, built a wooden fortress on the north bank of the Moscow River, the first Kremlin, which became the center of the medieval city and eventually of an independent principality, called Muscovy. The princes of Muscovy became rich and powerful during Russia's dark period of Mongol occupation, due to the



*The Kremlin is not only the political center of Russia, but also the geographic center of Moscow.*

fact that they were employed by their Mongol overlords as tax collectors. Eventually, the princes became strong enough to overthrow the Mongols and to unify the other Russian principalities into one state. The Kremlin was rebuilt in the early 15th century, and it remains one of the greatest monuments to native Russian architectural styles, notably in the many churches and monasteries contained within its walls: the churches of the Assumption, Annunciation and the Archangel Michael. Prince Ivan "the Terrible," completed the task of unifying Russia and in 1547 assumed a new title, *tzar*, reflecting his claims to imperial status and his conceptualization of Moscow as the "Third Rome," spiritual heir to the fallen empire of Constantinople.

The capital was moved from Moscow to Saint Petersburg by Peter the Great in 1712, as part of Peter's efforts to bring Russia closer to the West and wider European culture. Over the next two centuries, Saint Petersburg and Moscow competed for position as Russia's major city, with Moscow frequently advocating conservative, traditional Russian and Orthodox culture, while aristocratic Saint Petersburg focusing on becoming as Western as possible. Saint Petersburg was considered Russia's head, but Moscow remained its



heart. Much of the city was burned in 1812 by its own citizens, successfully forcing Napoleon's French troops to evacuate the region, a moment heroically immortalized in Peter Tchaikovsky's "1812 Overture."

### MODERN MOSCOW

Much of the architecture of the city reflects the rebuilding of the city in the following decades. The palaces in the Kremlin were rebuilt, including the Great Palace and the Palace of Congresses which today house the major government organs of the Russian state. Large squares replaced narrow streets and rickety wooden buildings, most notably Red Square along the east side of the Kremlin, the site of parades and ceremony to this day. After the revolutions of 1917, Vladimir Lenin recognized the value of Moscow's central location, as well as its defensibility from foreign invasion, and moved the capital back to Moscow. It became the capital of the Union of Soviet Socialist Republics officially in 1922.

Growth of railway lines and heavy industry was sped up, and millions of peasants, now landless and homeless, flocked to Moscow to find work. During the 1920s, the percentage of working-class residents living with the city's Garden Ring (the central region) increased from 5 percent to 45 percent. Cramped living conditions were finally tackled in massive building campaigns in the 1960s, resulting in today's huge apartment complexes around the city's edges, many built too fast and of inferior quality. Other buildings included monumental Soviet architecture, including Josef Stalin's infamous "seven sisters" skyscrapers.

Today, more than 8 million people live in Moscow, 11 million including its suburbs. In the past decade, large numbers of non-Russians have moved to the city, including Tatars, Chechens, and other peoples from the Caucasus. Moscow's speedy industrialization of the mid-20th century has left behind numerous air- and water-pollution problems. Moscow is a city of great contrasts, between ancient monasteries and ultra-modern office buildings, New Russian millionaires and poverty-stricken communist pensioners.

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## Mosquito Coast

THE MOSQUITO COAST, or Mosquitia, is located on the east coast of NICARAGUA and HONDURAS. The name is derived from the Miskito, the indigenous people of the region. The Miskito are descendants of the Chorotega, an aboriginal people of South America. Because of the absence of historic ruins, little is known of the Chorotega people, except that they were contemporaries of the Maya to the northwest. The word *Miskito* was corrupted into *Mosquito* by European settlers. Although its name sometimes applies to the whole eastern seaboard of Nicaragua and to Mosquitia in Honduras, the Mosquito Coast more accurately consists of a narrow strip of territory, along the CARIBBEAN SEA, stretching inland for about 40 mi (60 km). The area extends from the San Juan River in northeastern Honduras and the Bluefields Lagoon in Nicaragua, centering on Cape Gracias a Dios on the border between Nicaragua and Honduras at the hump of the Central American isthmus. The primary towns in Mosquito include Bluefields, Magdala on Pearl Cay, Prinzapolca, Vounta, and Carata. Bluefields, being the largest town, serves as the unofficial capital.

The Miskito natives, of whom there are several tribes, are short and dark skinned. The expanse of the Mosquito Coast is a combination of coral-lines, low shorelines, reefs, shoals, sandbars, swamps and small islands. It is a desolate region infested with black flies and rampant with yellow fever and malaria. Moving away from the coast, the land rises into savannas and pine woods that feed into the mountains. It is a hot, humid, and swampy region. It has also been historically a political and international hotbed.

Seventeenth-century Spanish settlements were primarily located on the Pacific coast of Central America. The Spanish didn't care for the barren Mosquito region and the hostile native Indians. Pirates and buccaneers during the period were viewed by the Mosquitia as allies against the Spanish. The Mosquito Coast historically encompassed the area that is now Nicaragua and was long under control of the British. The first European settlement in the Mosquito region was founded in 1630, when the English-chartered Providence Company occupied two small cays and established relations with the local inhabitants.

From 1655 to 1850, Great Britain claimed a protectorate over the Miskito natives. There was little interest in colonization by British settlers because of the adverse climate. SPAIN and the UNITED STATES opposed British authority out of territorial concerns over a pro-



posed canal and coastal ports. The 1848 uprising by the Mosquito Indians, supported by the British almost led to war. An agreement was reached not to fortify, colonize or exercise dominion over any part of Central America by Britain and the United States. Great Britain relinquished its protectorate of the Miskito native tribes to Honduras in 1859, which resulted in another Indian revolt.

The treaty of Managua in 1860 transferred to Nicaragua domain over the entire Caribbean coast but granted autonomy to the Miskito natives. Nicaragua was limited by native right of self-government. After enjoying independence for almost 14 years, the natives voluntarily surrendered their position and territory in 1894 and the Republic of Nicaragua was formally established. The Mosquito Coast became part of Nicaragua under president José Santos Zelaya. The northern area was awarded to Honduras in 1960 by the International Court of Justice, thus ending a long-standing dispute. The Nicaraguan portion was officially given partial autonomy in 1987, but little real change has resulted and the area remains impoverished. Rubber, lumbering, slash-and-burn cultivation for rice and beans as cash crop farming, mining, banana and plantain plantations are the primary occupations of the indigenous Miskito people. Lobstering has replaced banana cultivation as the major economic activity.

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## Mozambique

**Map Page** 1116 **Area** 309,496 square mi (801,590 square km) **Population** 17.6 million **Capital** Maputo **Highest Point** 7,992 ft (2,436 m) **Lowest Point** 0 m **GDP per capita** \$1,100 **Primary Natural Resources** coal, natural gas, titanium ore, iron ore.



MOZAMBIQUE IS located in southeast Africa and is about twice the size of CALIFORNIA. It is bordered on the north by TANZANIA, on the east by the MOZAMBIQUE CHANNEL of the INDIAN OCEAN, on the south and southwest by SOUTH AFRICA and SWAZILAND, and on the west by ZIMBABWE, ZAMBIA, and MALAWI. The only natural borders are Lake MALAWI in the northwest between Malawi and Mozambique and the Rovuma River, which forms part of the northern border with Tanzania. The Mozambique Channel separates Mozambique from the island of MADAGASCAR. Mozambique has 1,600 mi (2,575 km) of coastline that is interrupted by numerous river mouths. The rivers that run through Mozambique to the ocean include the Rovuma, Lurio, Incomati, Lugela, Revue, Save, Limpopo, and the famous Zambezi. South of the Zambezi, the coast is very narrow and the northern coast near Rovuma features rocky cliffs with numerous islets and lagoons. To the far south, just above South Africa, are Maputo Bay and the capital city of Maputo.

The Zambezi River flows through the north-central area of Mozambique and is the most fertile part of the country. It is the only navigable river in the country with a heavy flow of water traffic from its mouth to the city of Tete. Above Tete, about 400 mi (645 km) inland on the Zambezi, is the huge hydroelectric plant Cabora Bassa. Most of the electricity created there is exported to South Africa.

The Zambezi River is the fourth-longest river in Africa, stretching some 2,200 mi (3,540 km) from where it begins, looping through northwestern Zambia to the spectacular cataract of Victoria Falls on the border of Zambia and Zimbabwe, through Lake Kariba and finally entering Mozambique.

### SAVANNAS AND LOWLANDS

Most of Mozambique is covered with tropical savanna and coastal lowlands that rise slowly inland to where they form plateaus, which are then broken by isolated mountain peaks. The highest of these lies to the north along the Zimbabwean border east of Lake Malawi and is called Monte Binga. One-third of Lake Malawi lies within the Mozambique border and this area is covered in tea and sisal plantations. Most of Mozambique's income comes from agriculture, making it one of the poorest countries in the world: 75 percent of the country is rural, growing cashews, copra, tea, sisal, and cotton. In the south, they grow rice, sugar-cane, bananas, and citrus fruits. They do raise cattle, sheep, and goats, but their numbers are kept low by the disease-carrying tsetse fly. Some fishing takes place in the

Mozambique Channel and mainly brings in shrimp for export.

Most of the population speaks a Bantu language and comes from 10 major ethnic groups. The Makua-Lomwe, living in northern Mozambique, make up nearly 50 percent of that region, along with the Yao and Makonde. In the center of Mozambique live the Thonga, Chewa, Nyanja, and Sena; in the south live the Shona and Tonga. Mozambique gained its independence on June 25, 1975, from PORTUGAL. The country is structured as a multiparty democracy with a free market economy. Mozambique has suffered through spells of droughts and heavy flooding in the decade that have severely hurt the economy.

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## Mozambique Channel

LOCATED OFF the country of MOZAMBIQUE in Africa, the Mozambique Channel lies within the INDIAN OCEAN, between the African continent and the island of MADAGASCAR. The currents in the Mozambique Channel usually form an anticyclonic system but sometimes they do flow directly south into the Agulhas Current off the coast of SOUTH AFRICA. This area is a seismically active region that is thought to be an offshore continuation of the eastern branch of the East African Rift. On April 29, 1952, a 6.0-magnitude EARTHQUAKE struck within the Mozambique Channel, and since then several earthquakes of this magnitude and higher have been recorded.

The Mozambique Channel is narrowest at 250 mi (400 km), across from the African mainland at Mozambique to Madagascar. Within the channel flows the Mozambique Current, which takes warm water from the South Equatorial Current to the north and moves it south along the coast of Mozambique, then in a counterclockwise circle, back up the channel moving north along the coast of Madagascar. During the mon-

soon season in October and November, this current has the potential of attaining velocities exceeding 3.7 mi (6 km) per hour. The tidal ranges in the channel can be up to 21 ft (6.4 m), with surface temperatures varying seasonally between 71.6 degrees F (22 degrees C) and 80.6 degrees F (27 degrees C).

The marine life in the Mozambique Channel is extremely diverse thanks to the warm water currents of the area. There have been more than 2,000 species of fish identified in the channel, along with 180 species of birds. Five different types of marine turtles live in the waters of the Mozambique Channel: Pacific green, loggerhead, hawksbill, leatherback, and olive ridley. There are also many types of dolphins, invertebrates, and macroalgae. Southern right whales migrate through the channel, while humpback and minke whales live year-round here. The marine habitats of the Mozambique Channel include coral reef, sandy beach, rocky shore, seagrass beds, and deep water.

It is generally agreed that Madagascar once was linked to the African mainland. The Mozambique Channel is underlain by continental crust, layers of sandstone and limestone, which are thought by many researchers to have once been bridges from Africa to Madagascar. There is some debate as to when exactly Madagascar moved to its present position, with the spreading of the Mozambique Channel. Some researchers say it was during the Cretaceous period and others say it was during the early to middle Cenozoic.

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## Mumbai (Bombay)

BOMBAY, RENAMED Mumbai in 1995, is a city in western INDIA and the capital of the Indian state of Maharashtra. With its three totally computerized stock exchanges that handle 70 percent of the country's stock transactions and manufacturing (particularly in textiles, which employs 11 percent of India's factory

workers), Mumbai is the most important economic center of South Asia. It is India's largest port in tonnage handled.

Mumbai is not only the largest city of India, with an estimated population of 16 million (2000), but is also the fifth-largest metropolis in the world. Mumbai is projected by the United Nations (UN) to be the third-largest city by 2015, when its population will reach 22.6 million.

The old city of Bombay, an island, has a lowland terrain and has gone through several stages of reclamation. It forms the southern tip of Greater Bombay. The main part of the metropolis is separated from mainland India by a narrow water body; to the west lies the Western Ghats mountain range. Located south of the TROPIC OF CANCER and falling in the monsoon climate zone, its annual rainfall averages 84 in (213 cm), mostly from June through September. Mumbai's average January temperature is 66 degrees F (19 degrees C) and the May average is 81 degrees F (27 degrees C).

### THE CITY'S HISTORY

Historically, Bombay was a fishing village ceded to Portuguese in 1534 by the regional ruler, Bahadur Shah. In 1661, it was transferred to the British as a wedding gift to King Charles II of England, when he married the sister of Portuguese king. The British king then leased the territory to the newly formed East India Company. A fort built in 1717 became the main center of colonial activity. The center of the fort had three radiating roads (still in existence) leading to the city's Apollo, Church, and Bazar gates. When congestion increased considerably within the fort, settlements spread outside the walls. The wall was torn down in 1861.

Mumbai is the most diverse Indian metropolis: 67 percent are Hindu, 14 percent Muslim, 7 percent Sikh, 6 percent Christian, 4 percent Jain, and 4 percent Buddhist. Though English is the language of the elites, 42 percent are Marathi speakers, 18 percent Gujarati, 11 percent Urdu, 10 percent Hindi, 3 percent Tamil, 3 percent Sindhi, and 2 percent Punjabi. The city has several masterpieces of colonial architecture: Victoria (Chatrapati Shivaji) Terminus, the Municipal Building, and the University of Bombay. It is a leading educational center; the University of Mumbai was founded in 1857 and several colleges, including medical colleges, are also prevalent.

Mumbai makes the largest number of films compared to any other city of the world. The metropolis is rightly called "Bollywood, the star machine of India."

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## Myanmar (Burma)

**Map Page** 1123 **Area** 261,970 square mi (678,500 square km) **Population** 42,510,537 **Capital** Rangoon **Highest Point** 9,692 ft (2,954 m) **Lowest Point** 0 m **GDP per capita** \$200 **Primary Natural Resources** petroleum, timber, tin, antimony, zinc, copper.



A KITE-SHAPED country with a 1,243-mi (2,000-km) north-south stretch, Myanmar has its apex in the north, bordering INDIA and CHINA, and a tail that extends for 900 km (559 mi) in the south. The British colonized the area known as Burma in 1875 and ruled it mainly as a province of India. Japanese occupation in 1942 lasted for three years, after which the British regained their colony, only to hand over power to the Aung San-led antifascist People's League in 1948. During the British period, most administrative, rail/port operations, postal, banking and trading activities were handled by Indians, who constituted 8 percent of the population.

Moreover, exposure of Burma to the foreign market induced the IRRAWADDY delta-based farmers to produce surplus rice, and the country became the leading rice exporter in the world. In 1940, Burma was exporting 3 million tons of rice annually. The country has not regained that position because of increased demand in the local market and the impractical policy of the "Burmese way to Socialism," which introduced a command economy.

Following independence in 1948, Burma had elected governments, but since 1962, it has been ruled by military dictatorships. After being pressured by the United Nations, the country held a national election in 1990, resulting in 82 percent of the parliamentary seats being won by the Aung San Suu Kyi-led prodemocracy party, the National League for Democracy. Aung San Suu Kyi is the daughter of the "Father of the Nation,"

Aung San. She was awarded the Nobel Peace Prize in 1991. The 1990 election was invalidated by the military junta and Suu Kyi was put under house arrest. Brutal suppression of free expression still continues.

Starting in the 1970s, the agricultural High Yield Variety (HYV)-based green revolution technique has been widely used, resulting in increased rice production. Some analysts believe Myanmar seems to be well on its way to reclaiming its previous position as the world's premier rice exporter.

Myanmar is primarily an agricultural country, with 60 percent of its gross domestic product coming from agriculture, while 78 percent of the labor force is engaged in that occupation. Industries, including agricultural processing, knit and woven apparel, wood and wood products, textiles, and pharmaceuticals employ

about 7 percent of the population. Myanmar had been producing petroleum since before World War II. The present production, however, remains stagnant.

Twenty-five percent of people live below the poverty line. High adult mortality from HIV/AIDS is slowing the population growth rate.

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## Namibia

**Map Page** 1116 **Area** 318,696 square mi (825,418 square km) **Population** 1,927,447 **Capital** Windhoek **Highest Point** 8,550 ft (2,606 m) **Lowest Point** 0 m **GDP per capita** \$4,500 **Primary Natural Resources** diamonds, gold, tin, copper, lead, zinc.



NAMIBIA, FORMERLY known as South West Africa (SWA), is located in southern Africa. It borders the South ATLANTIC OCEAN, NAMIBIA, ANGOLA, BOTSWANA, SOUTH AFRICA, and ZAMBIA. Namibia can be divided into four major geographical segments. In the west, stretches the great Namib Desert, which extends along the Atlantic coast from the northern part of South Africa to the southern border with Angola. This desert belt varies in width from about 62 mi (100 km) in the south to as much as 680 mi (1,100 km) in the north, and has mighty sand dunes in the central part up to 1,968 ft (600 m) high. The northern and the southern extremes of the desert are predominantly gravel fields.

Moving inland, the desert belt gives way to the escarpment, a mountain wall up to 6,500 ft (2000 m) high. Beyond the escarpment, the land changes into the

Central Plateau region, which slowly descends toward the east. The majority of Namibian towns and villages lie on this plateau, including the capital of Windhoek at 5,425 feet (1,654 m). Farther to the east lies the Kalahari Basin and the great KALAHARI DESERT, which is characterized by wide sandy plains and long-dunes with scarce vegetation.

Another unique geographical area is the relatively rainy Kavango and Caprivi region in the extreme northeast. It is flat and covered with dense bushveld. Because the climate is continental, tropical, and very dry, most of Namibia's rivers are dry except during rains. Perennial rivers, such as the Okavango, Kunene, Zambezi, and Orange are confined to Namibia's northern and southern borders areas. The coast is cooled somewhat by the BENGUELA CURRENT. The meager and highly variable precipitation is not very effective in watering the land because of a high rate of evaporation. Average rainfall increases from the southwest to the northeast. The territory suffers from prolonged, periodic droughts. The vegetation is generally sparse except in the far north.

Namibia's widely varied animal life includes the lion, leopard, elephant, rhinoceros, giraffe, zebra, ostrich, and antelope. The country's most renowned game reserve is the Etosha National Park, one of the largest in the world. Namibia has relatively abundant natural resources. Among the most significant are dia-

monds, particularly those that can be found in the sands of the Namib Desert along the Atlantic coast. Like South Africa, there are also important deposits of gold. Namibia is a sparsely populated multiracial country where half of the population is concentrated in the northern region known as Ovamboland. The Ovamboland is home to many ethnic groups, including the Ovambos, who represent 50 percent of the population, and the Kavangos and Caprivians. The white settlers (6 percent) occupy the central and southern highlands along with other smaller, ethnic groups. The white population consists of Afrikaners, British, and Germans. In 1990, the country became an independent nation after a long period of liberation struggle. Since then, the country has been stable politically under Sam Nujoma, who led a prolonged fight against South African rule in Namibia.

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## Nap of the Earth

*NAP OF THE EARTH*, or NOE, is a Vietnam War-era term for very low-level flight, particularly of helicopters. The concept behind this type of flying is that a pilot guides his or her craft as close to the Earth's surface as terrain, vegetation, and other obstructions will allow and maintains that low altitude while approaching a chosen target or transiting an area. This flight technique becomes a tactic for surprise and survival as the aircraft comes into and passes out of a ground observer's field of vision before an enemy can target and engage the aircraft. It also has the advantage of getting the aircraft below acquisition radar detection envelopes and blending in with the ground clutter provided by vegetation and intervening topography. This type of flight is included in the more inclusive term *terrain flight* or TERF.

An official Department of Defense definition is: "Flight close to the Earth's surface during which air-

speed, height, and/or altitude are adapted to the contours and cover of the ground in order to avoid enemy detection and fire."

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## nationalism

THE MODERN CONCEPT of nationalism was born with the Treaty of Westphalia in 1648. Before then, Europe was a checkerboard of small states, cities, principalities, and alliances united by religions, language, history, and politics. As recently as the 1800s, such nations as CHINA, INDIA, and even ITALY looked nothing like they do today but instead were divided into such multiple states, cities, principalities, and alliances. The concept of nationalism was foreign to much of Africa and Asia as well, which were divided by language, culture, tribal ethnicity, politics, and geography.

The Westphalia peace agreements ended the Eighty Years' War between SPAIN and the NETHERLANDS as well as GERMANY'S Thirty Years' War. SWEDEN'S and FRANCE'S borders were clearly identified. The United Provinces of the Netherlands became a nation. A variety of mountainous city-states calling themselves the Swiss Confederation became an independent republic. Germany's treaty ended a century-long struggle between the Holy Roman Empire and 300 German princes who ruled over a variety of dominions. The Peace of Westphalia recognized the full territorial sovereignty of the member states. The princes were empowered to contract treaties with one another and with foreign powers. They became absolute sovereigns in their own dominions: nations.

The Versailles Treaty ending World War I further recognized the principle of nationalism with Europe and the MIDDLE EAST divided into autonomous entities empowered to take care of their own affairs. A number of such brand-new states were carved out of the defeated Ottoman Republic as British administrators created with the stroke of a pen on a map such countries as JORDAN, SAUDI ARABIA, IRAQ, and IRAN—ignoring ge-

ography as well as historic, ethnic, and religious differences. For example, what might have been a homeland for the Kurds was separated by artificial borders and assigned to the new Iraq, Iran, and TURKEY.

Created by diplomats, Yugoslavia was made up of several intensely rivalrous Balkan states with historical differences and competing interests. It held together until the death of its head of state, Josip Broz Tito, dissolving into such nations as SLOVENIA, BOSNIA, and SERBIA AND MONTENEGRO. One of the former Yugoslav republics goes by the official United Nations-assigned title of the Former Yugoslav Republic of MACEDONIA since adjacent Greece is worried that declaration of an independent Macedonia would prompt a wave of nationalism among Greek Macedonians, who would want to secede from Greece and join the new all-Macedonian nation.

The collapse of Yugoslavia and the dissolution of the Soviet Union at the close of the Cold War resulted in even more independent nations. Nationalism continued to assert itself in such ways as DENMARK refusing to give up its national currency in favor of the EUROPEAN UNION's new currency, the euro. IMMIGRATION became a controversial issue in Britain, with some vocalizing that the British identity was blurring. Nationalistic parties did well in French and Dutch elections. Polls showed that most people continued to have a strong sense of attachment to their nationality. GLOBALIZATION was violently opposed in massive worldwide street demonstrations.

Yet, significant antinationalistic trends also took place. The EUROPEAN UNION transferred significant power from the national level to both local and continental bodies. Historic trade agreements such as the NORTH AMERICAN FREE TRADE AGREEMENT (NAFTA) lowered the economic borders between the UNITED STATES, CANADA, and MEXICO. Such counternationalism increased the internationalization of trade markets while weakening the sovereignty and authority of the nation states. Even so, nationalism has maintained its appeal. Belonging to a culturally, economically, or politically strong nation seemingly makes citizens feel better regardless of whether they have made any contribution to that strength.

Regrettably, nationalism can have extreme negatives. In the 1980s, a very negative nationalism was projected by an Argentine military junta desperate to avert popular attention from inflation and unemployment as well as institutionalized corruption and the outright murder of thousands of political opponents. Amid loud proclamations of national pride and des-

tiny, Argentina invaded the remote FALKLAND ISLANDS, proudly proclaiming that Las Islas Malvinas (as Argentines call the islands) had been "liberated" and restored to the Argentine motherland. The few hundred inhabitants, mostly shepherds, spoke English and traced their roots to England. They appealed to Great Britain for rescue. Argentina was startled when the British mobilized, sinking Argentine navy ships, destroying the Argentine air force, and invading the islands, thereby precipitating the collapse of the Argentine government—deposed in a twist of nationalism as the Argentine people repudiated their actions. Whereas this manifestation of Argentine nationalism was politically motivated and manipulated, nationalism has many forms, which can be positive as well as negative and which include ethnic, religious, historical, linguistic, geographical, and civil nationalism.

### ETHNIC AND RELIGIOUS NATIONALISM

Ethnic nationalism exists when the state derives political legitimacy from hereditary groupings and ethnicities. A very negative example would be RWANDA and BURUNDI when, in 1994, frenzied by radio broadcasts, leaders called for a national "cleansing" of both nations. Half a million Tutsi tribespeople in Rwanda and another 300,000 in neighboring Burundi were murdered over a three-month period in which families were hacked to death by machete and refugees huddling in church sanctuaries were burned alive. Perpetrators expressed little remorse, explaining that they were merely ridding the world of Tutsis.

A positive example would be the experience of SWAZILAND. According to Swazi legend, in the late 18th century, Chief Ngwane II led a small band of followers over the Lebombo Mountains, found other African peoples, made peace with them, and together they became what today are the ethnic Swazi. After a difficult British colonial period, Swazi independence was granted in 1968. A new constitution written in 1973 took care to reflect Swazi national traditions, including the rule of the Ngwenyama or king as the country's hereditary head of state, assisted by a council of elders and the Ndlovukazi or mother of the king, who for centuries has been in charge of national rituals. Today, Swaziland is a leader among southern Africa's emerging nations—united by a rich history, proud culture, and unique ethnicity.

Religious nationalism exists when the state derives political legitimacy as a consequence of shared religion, such as Judaism in ISRAEL, ISLAM in PAKISTAN, Catholicism in Italy, or Shintoism in JAPAN. One familiar ex-

ample would be the independence movement on the Indian subcontinent following World War II. Protesting the policies of an occupying nation that insisted that India was British and would always remain so, thousands of indigenous Indians put aside language, geographical, religious, and historical differences to unite, refusing to cooperate with colonial administrators. Mohandas K. Gandhi exhorted the masses to shame the British into leaving the Indian subcontinent through passive revolt, refusing to submit to the authority or rule of the occupiers, and instead asserting that the right to govern belonged to those whose ancestors had been there for thousands of years, and that no government would be better than a government by outsiders. On the eve of independence, however, religious differences between Muslims and Hindus split the proposed new nation apart. Muslim provinces on the east and west sides became Pakistan. What had been scores of small rival states united as the predominantly Hindu nation of India. Although it also had been administered as part of British India, the Buddhist kingdom of Burma had no interest in joining the confederation and instead sought its own independence as MYANMAR.

Another example is IRELAND. The inhabitants of most of the island are Catholic. The northern province of Ulster is Protestant as a result of the politically motivated importation of Scottish Presbyterians centuries ago. These Scots-Irish have remained geographically, religiously, ethnically, and linguistically separate from the rest of Ireland, electing to remain a part of Great Britain. Irish nationalists who have used violent means to seek the unification of the island are nominally motivated by religion, yet one never hears the Irish Republican Army offer to debate the Scots-Irish Protestants of Ulster on celibacy, predestination, or the authority of the papacy. Instead, they fight over nationalistic ideologies, views of Irish culture, and the status of the British army. Nevertheless, the conflict is popularly regarded as religious.

## HISTORICAL NATIONALISM

Another kind of nationalism is historical nationalism. In this case, nationalism is projected because of the pride that inhabitants take in the history and heritage of their nation. An example is GREECE. Citizens on the Greek peninsula and islands feel great pride over their nation's rich past as the birthplace of democracy as well as the incubator of Western philosophy and the historic home of the Olympics. During World War II, Greek partisans were fierce defenders of their home-

land, driven by a love of their homeland, culture, traditions, and their distinct national identity.

In China during the 1800s, furious that foreign occupiers had subjugated their leaders and introduced nationwide opium abuse, Shaolin monks led their followers in a futile attempt to drive European occupiers out of China. Armed with only bare fists and deep beliefs, these predecessors of today's kung fu and karate practitioners failed to liberate China in what Westerners would dub the Boxer Rebellion.

Instead, China was forced at gunpoint to sign over a number of Chinese coastal cities as foreign enclaves, serving as doorways and giving the Europeans trade access to China. The last of those, Britain's HONG KONG and PORTUGAL's Macao, were ceded back to China only at the turn of the millennium—the result of nationalistic demands on the part of the China, which had never forgotten its historic humiliation. The entire Chinese nation celebrated the return of the two cities with nationwide festivities and proclamations of Chinese national pride.

A common language has been one of the main pre-suppositions for nationalism. In FRANCE, for example, before the French Revolution, dialects such as Breton and Occitan were spoken in the various regions and were incomprehensible to each other. Following the Revolution, French was imposed as the national language. Nationalism has also prompted the revival of languages, such as Gaelic after Ireland won its independence, and Hebrew upon the founding of the state of Israel.

Civil nationalism exists when the state derives political legitimacy from the active participation of its citizenry, as in the “will of the people.” An individual in such a nation must believe that the state's actions somehow reflect his or her will, even when specific actions go against that will. It is the theory behind constitutional democracies such as the United States. A dramatic example of civil nationalism is South KOREA. With their national economy threatened by a 1990s recession, thousands of South Koreans sold family heirlooms and melted down precious jewelry so they could make voluntarily contributions toward paying off the national debt and restoring the prosperity of their industrialized, market economy.

Many citizens remembered well the difficult days of the Korean War and, before that, the Japanese occupation in World War II. Although united by thousands of years of history with the ethnically and linguistically identical inhabitants of the communist northern half of their peninsula, South Koreans remain skeptical of re-



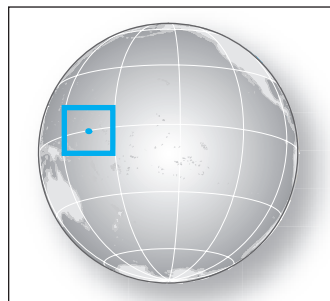
unification with North KOREA, which has a hereditary, non-democratic government and a centralized socialist economy. South Koreans have fought and sacrificed for their nation's security and prosperity—and take strong nationalistic pride in being South Koreans.

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## Nauru

**Map Page** 1128 **Area** 8 square mi (21 square km) **Population** 12,570 **Capital** None, government offices in Yaren District **Highest Point** 200 ft (61 m) **Lowest Point** 0 m **GDP per capita** \$5,000 **Primary Natural Resources** phosphates, fish.



NAURU, LOCATED near the equator south of the MARSHALL ISLANDS in the south PACIFIC OCEAN, is the world's smallest independent republic. The country, officially known as the Republic of Nauru, gained its independence from the AUSTRALIA-, NEW ZEALAND-, and UNITED KINGDOM-administered United Nations trusteeship on January 31, 1968. The exportation of phosphate, principally to Australia, New Zealand, South KOREA, and INDIA, is the primary economic source for the island. However, the phosphate deposits are predicted to become exhausted in the coming decade. To prepare for this, the government has begun to pursue other economic strategies such as the registration of offshore banks and corporations and tourism.

Sea-faring Polynesians and Melanesians first inhabited the island. First contact with Europeans came in the 1830's when whaling ships first encountered the island. During World War II the island came under naval fire from first the Germans and then was later occupied by the Japanese. The Japanese occupied the island and

forced over 1,000 Nauruan to work as laborers in the Caroline Islands, where nearly half died. Following the war, the island became a United Nations Trust Territory until its independence in 1968.

The main ethnic group on the island is the Nauruan, comprising 58 percent of the population. Other groups include Pacific Islander, 26 percent; Chinese, 8 percent; and European, 8 percent. The official language of Nauru is Nauruan which is a distinct Pacific Island language. English, though, is widely understood and spoken and used for most government and commercial purposes on the island. A majority of the population is Christian; two-thirds of the population is Protestant and the other third Roman Catholic.

The climate is tropical. The island averages 78 in (200 cm) of precipitation per year, and the monsoon season runs from November to February. Average daily temperatures range between 75 to 93 degrees F (24 to 34 degrees C) with an average humidity around 80 percent. The central plateau is where the phosphate mining takes place, and as a result, four-fifths of the total land area of the island has been lost. Jagged coral pinacles, up to 49 ft (15 m) high, and coral cliffs dominate the resulting landscape on the plateau. The island is surrounded by a coral reef bordered by deep water on one side and sandy beach on the other. Next to the beach is a wide fertile coastal strip.

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## nautical mile

A UNIT OF DISTANCE used primarily at sea and in aviation, the nautical or sea mile is based on the average meter distance on the Earth's surface represented by one minute of latitude. Because it is based on the earth's dimensions, the nautical mile is extremely convenient to use for any type of navigation. Adopted in 1954 by the U.S. Secretary of Commerce and the Secretary of Defense, and used in maritime and aerial navigation, in relation to how boat speeds and wind velocities are measured (one knot is one nautical-mile-per-hour), a nautical mile is approximately one minute of latitude and it is used to express distance. The nautical mile, which is outside of, but accepted by, the In-

ternational System of Units (SI), the modern version of the metric system, was for years established by Britain at 6,080 ft or 1853.18 m. There is no internationally agreed symbol for the nautical mile.

A nautical mile is approximately a minute of arc (a unit of angular measurement equal to one sixtieth of one degree) along a great circle of the Earth. That is, if the Earth was sliced into two equal halves through the center along the equator and then divided along the perimeter into 360 degrees, and each degree into 60 arc minutes, the result (although the Earth is not a perfect sphere) would be close to one nautical mile.

At sea level one minute of angle equals 1.15 miles or one nautical mile. As such, the nautical mile differs slightly from definitions of other miles including the international nautical mile, which was adopted by the International Extraordinary Hydrographic Conference in 1929 at exactly 1,852 meters. Around since the time of the Roman Empire, the term *mile* had many meanings over the centuries. The Roman mile was 5,000 ft in length or 1,479 m in modern dimensions.

Most people are more familiar with the land or international mile. Used in the United States and Britain as part of the imperial system of units, the land mile is defined, by a 1959 international agreement, to be exactly 5,280 international ft or 1,609.344 m. The United States makes use of the statute mile, which was adopted by Congress before the international nautical mile was established.

The statute mile, derived from U.S. geodetic surveys after the adoption of the international mile and used by the U.S. Coast Guard, is one-quarter inch longer than the international nautical mile at 5,280 ft. The geographical mile, a unit of length determined by one minute of arc at 6,087.15 ft, is also closely related to the nautical mile.

Nautical miles are also related to speed in that the nautical mile and the knot, a unit of speed equal to 1 nautical mile per hour (1,852 m), are the bases of sea and aerial navigation. During the days of wooded boats, sailing speed was calculated by unraveling a knotted rope into the water behind the ship. The number of knots that passed over the side of the ship during a given time (most ships during this time used a 28-second sand hourglass) would indicate how fast the ship was traveling. Today, aircraft velocity gauges and flight routes are calibrated and denoted in knots and nautical miles.

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## Nebraska

KNOWN AS THE Cornhusker State, the west north-central state of Nebraska was named from a Native American word meaning “flat or broad water.” It lies within the Missouri River basin; the western part of the state also lies within the Platte River basin. Nebraska covers an area of 77,354 square mi (200,346 square km), making it the 16th largest state in the UNITED STATES. Nebraska is 38th in population among the 50 states. The state is 430 mi (692 km) east to west and 210 mi (338 km) north to south. Some 95 percent of Nebraska is devoted to agriculture in some way.

Nebraska makes up the westernmost edge of North America’s Central Lowlands and is part of the Great Plains. It is bounded on the north by SOUTH DAKOTA, on the south by COLORADO and KANSAS, on the east by IOWA and MISSOURI, and on the west by Colorado and WYOMING. Nebraska entered the Union in 1867 as the 37th state. The state capital is Lincoln. Other large cities include Omaha, Bellevue, Grand Island, Kearney, Fremont, Norfolk, North Platte, Hastings, and Columbus.

The highest point in Nebraska is 5,424 ft (1,653 m) above sea level in Johnson Township; the lowest point is 840 ft (256 m) above sea level at the Missouri River in Richardson County. Much of Nebraska’s topography is dominated by till plains, with lowlands evident in the eastern third of the state, which is part of the Dissected Till Plains that extend to the Great Plains in northern Nebraska. The Dissected Till Plains are characterized by rolling hills dotted with numerous streams and rivers, providing the richest farmland in the state.

Nebraska’s Great Plains contain the Loess Hills, made up of loamy dust distributed by the wind, varying in color from buff to a yellowish brown. The terrain is rough and hilly. In the Loess Plains that lie in the southeastern part of the region, the land is flatter and more conducive to farming. Because of its frequent

rainfall, this area is sometimes called the Rainwater Basin or the Rainbasin. In LOESS areas of Nebraska, silty soils that are conducive to farming are the most common. In the eastern third of Nebraska, soils are more likely to be low-permeability clays that make irrigation difficult.

A 20,000-square-mi (51,799-square-km) section of Nebraska lying north of the Platte River is known as the Sand Hills, which is the largest area of sand dunes on the North American continent. Abundant grass and readily available water from the hundreds of lakes found throughout the area make this area excellent for grazing.

Nebraska's High Plains lie north and west of the Sand Hills. In this dry area, advances in irrigation technology have allowed some farming, while rougher terrain is used for grazing. Nebraska's badlands are located in the northwestern section of the state. Distinctive formations have been formed in the badlands by wind and water.

Nebraska's climate is continental, resulting in hot summers with frequent thunderstorms and occasional hail and tornadoes. Harsh winters are accompanied by an annual snowfall of 29 in (73.6 cm), with occasional blizzards. The state is somewhat drier than other midwestern states. Average temperatures range from 89.5 degrees F (32 degrees C) in the summer to 8.9 degrees F (-12.8 degrees C) in the winter. Annual precipitation ranges from 33 in (84 cm) in southeast Nebraska to 18 in (45.7 cm) in the west, resulting in a growing season of 170 days in the southeast and 120 days in the northwest section of Nebraska. Draughts are common. Nebraska's largest rivers are the Missouri, the Niobrara, the Platte, and the Republican. The state's largest lakes, including Lewis and Clark Lake, Harlan County Lake, and Lake C.W. McConaughy, are man-made.

Recognized as a major grain producer, Nebraska's approximately 48,500 farms and ranches produce corn, sorghum, soybeans, hay, wheat, dry beans, oats, potatoes, sugar beets, and livestock. Nebraska is also home to the greatest number of forage grasses in the country. Natural resources include oil, natural gas, cement, stone, sand and gravel, and lime. Manufacturing in Nebraska is dominated by processed fuels, industrial machinery, publishing, electric and electronic equipment, metal products, mobile homes, pharmaceuticals, chemicals, and transportation equipment.

Oak, hickory, and elm trees are plentiful in the river valleys of Nebraska's east, and cottonwood and willow, as well as elm, are found in the west. Ponderosa pine predominates in the Great Plains area.

Bluestem grasses are most commonly found on Nebraska's prairies, while grama, buffalo, and sagebrush grow in Nebraska's dry Panhandle. Sand sage and grama grow throughout the southwest. Nebraska's wildlife population includes the coyote, antelope, deer, fox, badger, prairie dog, pheasants, and quail. Bison are found in isolated areas of the state.

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## needs and wants

WANTS AND NEEDS are concepts that have come to be developed around three different spheres of discussion, biological, social, and economic. Each is an expansion in size and scale over the one preceding it. In addition, it is important to remember that the subject is biological in character. This means that we do not discuss the wants and needs of inanimate things. The second important point to recognize is that "wants" are subservient to "needs" and, as far as we know, restricted to the realm of humans. From this perspective, we can think of wants as some specific expression of how we choose to meet those needs.

The discussion of wants and needs has an origin in Greek thought more than 2,500 years ago in works by Xenophon, Aristotle, Plato, and Protagoras. But their discussion of the issue was fairly broad and aimed primarily at what constitutes good administration as the driving force in society.

However, Protagoras did make a distinction between human perception and physical phenomena, stressing that hedonic calculus (self-interest) is a vital element in individual decisions. These ideas held for more than 1,200 years until the subject was once again discussed at length during the Scholastic Period beginning in the 1200s. Here, the writings of Albertus Mag-

nus and Thomas Aquinas began to explicitly explore what they called *indigentia*, or human wants. But the writing was vague in the sense that the distinction between wants and needs was far from clear. At the end of the 18th century, the Classical School of economic writers once again found room for wants and needs in their writings. But the development of economic ideas during this time considered human wants and needs to be insatiable (and generally identical), and as such, the real interest was in finding ways to economically balance unlimited wants with limited resources. The importance here is that the reference to limited resources marks the first time that geographic factors are openly included as an important element in the wants and needs discussion.

During the 19th century all forms of science began to blossom, including psychology. One of the areas of development within psychology was a new examination of human need. Psychologists quickly established certain primal needs such as those involving physiology: the need for food and shelter, where food also includes drink and where shelter can refer to clothing, housing, or other individuals. By the mid-20th century a wide variety of needs were being identified and debated, but they were generally related to biology, achievement, or power. Probably the most well known of these were put forward by Abraham Maslow (1943). Maslow developed a conceptual framework that suggested a hierarchy of human needs addressing issues as either growth needs or deficiency needs and where each lower-level need must be met before the one above it can be fulfilled.

If you review all that has been discussed, you will find that most of the discussion can be put into one of two boxes, things that are instinctive and things that are learned responses. In doing this, the differences between needs and wants not only becomes much clearer, but it is possible to extend the thinking to areas beyond the biological and make use of the ideas within a geographic context.

### HUMAN INSTINCTS

Instincts are hardwired into the brain, the genetic legacy of millions of years of evolution. Instincts make a creature react automatically to stimuli, with the brain carrying out instinctive reactions without conscious control. But we must not think that instinct is fixed. There can, of course, be evolution in instinct. On occasion an aberrant instinct can be more efficient as a survival or reproductive mechanism than the original instinct. Thus, the aberration has a better chance of

survival, of reproducing, and of passing on to future generations, the original instinct dying out.

The second element of the subconscious mind is learned response. A learned response is one that mitigates or modifies an instinctive reaction. It is instilled in a person through a series of steps: emotions, belief, attitude, feelings, and behavior. Emotions, loosely defined as feelings, are the result of two things: the instincts discussed earlier and *a priori* assumptions. *A priori* assumptions are those conclusions based on theory rather than experience or observation, premises arrived at without examination of evidence. The basis for *a priori* assumptions is culture and upbringing, what sociologists call socialization or programming. Basic instructions on how to regard the world first come from the family.

### HUMAN PROGRAMMING

In human terms, programming tells one how to regard what comes in through the senses. The family is not the only source of programming, of course. As a person gets older, other influences come into play: school, church, peers, teachers, television, books, anyone and anything that provide ways of regarding the world and the people in it. Programming leads to belief: what a person is programmed to believe is what that person does believe. What leads from a person's beliefs is that person's attitude toward the world and the things in it, the next step in learned response. When one believes something is bad, the attitude toward it is one of distaste. The attitude leads to the next step: feelings. Feelings are the actual human emotions that result from the instinctive and learned response reaction to a stimulus. On the basis of feelings, humans respond. Their initial response is to their instinctive reaction to stimuli. However, this is coupled with their learned response and becomes their behavior. Actual behavior is the final level. It is what people do in response to a stimulus, the external manifestation of their attitudes.

Each of the points indicated above suggests the geographic character of the wants/needs issue. We can take needs as given and apply them anywhere we want. Wants, on the other hand, are socially determined and as such reflect the degree to which the geographic environment (our physical and cultural surroundings that provide the basis for our emotions, beliefs, attitudes, feelings, and behavior) gives specific meaning to satisfying needs. While we accept human need as uniform among all people, the world's resources for satisfying them are not equally distributed among regions. This difference is what often leads to stereotyping and



sometimes conflict. It is also a strong driving force behind territoriality, a key factor in GEOPOLITICS and the game of nations.

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## Negev Desert

**THE NEGEV IS** A part of the Saharo-Arabian desert belt running from the ATLANTIC OCEAN across the SAHARA and Arabia to the Sind desert of INDIA's Indus Valley. The Negev, also spelled Negeb, means both "the southland" and "dry." Negev is derived from the Hebrew verbal root n-g-v meaning "to dry." The Ha-Negev (Hebrew) covers about 60 percent of southern ISRAEL. It is a triangular shaped arid region of some 5,019 square mi (13,000 square km). The apex of the triangle is the port city of Elat (Eilat) on the RED SEA. The eastern leg of the triangle is formed by the Syro-African Rift valley from Elat to the dead sea. The western leg of the triangle is bounded by the SINAI PENINSULA (EGYPT). The western boundary extends from the southern end of the Gaza strip coastal plain to Elat. The base of the triangle lies along an east-west line at about 30 degrees 25 minutes N.

The Negev is small in area but has five regions: the Northern Negev, the Western Negev, the Negev Highlands, the Southern Negev, Arabah (Arava). Some scholars also include the Dead Sea as a sixth area. The Northern region is a small ribbon of land running east-west that includes the city of Beersheba (Beer Sheva) which is "the capital of the Negev." The soils are fairly fertile, with enough rain for wheat to grow. The Western Negev stretching from the Gaza strip and the Sinai Peninsula to the Negev highlands, receives about 10 in (25 cm) of rain annually. The LOESS soils in the area are good for growing cereals.

The Negev Highlands is a high, dissected plateau averaging 1,200 to 1,800 ft (400 to 600 m) in eleva-

tion. The highest point is 3,395 ft (1,035 m). The area receives only about 4 in (10 cm) of rain per year. In this area are many erosion craters (makhteshim) formed by the erosion of the upward-folded (anticlines) limestone strata. The two largest are the Ramon Crater and the Great Crater.

The Arabah Valley (Wadi al-Jayb) is 111 mi (179 km) long, from Elat to the Dead Sea, and is bounded on the east by JORDAN. It is very arid. While the Negev is a DESERT, it is not as arid as the Sahara to the west or the Jordanian desert to the east. Many desert plants, animals, reptiles and birds flourish in the Negev. Modern irrigation projects have made many areas bloom.

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## Nepal

**Map Page** 1123 **Area** 87,489 square mi (140,800 square km) **Population** 27,070,666 **Capital** Katmandu **Highest Point** 29,035 ft (8,850 m) **Lowest Point** 230 ft (70 m) **GDP per capita** \$1,400 **Primary Natural Resources** quartz, water, timber.



**NEPAL, LOCATED** between two Asian giants INDIA and CHINA, is a small country of approximately the size of the American state of FLORIDA. It extends some 500 mi (805 km) from east to west in an elongated rectangle along the arc of the HIMALAYAS.

The northeastern section of the country lies in the same latitude as northern Florida; the southeastern extremity, in the latitude of Fort Lauderdale; and Katmandu, the capital, in the latitude of Tampa. Its altitude varies from 197 to 722 ft (60 to 220 m) in the south to the highest mountains in the world in the

north. Nepal is a land of great diversity. There are dense swampy jungles, rich rice-clad valleys, bleak alpine highlands, and towering snow peaks within a comparatively few miles of each other. The northern interior has bitterly cold winters, whereas the southern Terai, less than 100 mi (161 km) away, has a humid, subtropical climate year-around. Into this diverse physical setting many ethnic groups have immigrated over the years to give the nation a racial and cultural pattern as varied as the land itself.

Except for a narrow strip along its southern border, Nepal lies entirely within the great mass of the Himalayas. By altitude, Nepal is divided into three distinct zones: One, the Terai, consists of the low Siwalik or Churia range of Hills, Bhabar, and Terai along the southern border of Nepal; two, the central mountainous belt, varying in altitude from 1,000 to 8,000 ft (305 to 2,438 m); and three, the alpine zone, comprising the higher slopes and valleys of the main Himalayan range and the trans-Himalayan districts of Manangbhot, Mustangbhot, and Charkhabhot.

The backbone of the Nepalese Himalayas contains many of the highest mountains in the world; from east to west there are: Kangchenjunga (28,168 ft or 8,586 m); Makalu (27,790 ft or 8,481 m); Everest (29,035 ft or 8,850 m); Cho Oyu (26,750 ft or 8,153 m); Manaslu (26,658 ft or 8,125 m); Himali Chuli (25,801 ft or 7,864 m); the Annapurna I (26,391 ft or 8,091 m); Dhaulagiri (26,790 ft or 8,174 m); and, in the extreme west, Api (23,399 ft or 7,132 m).

These ranges divide the country into four distinct regions. The western region extends from the Sarda, or Mahakali River, to the Dhaulagiri range. The central region comprises the basin of the Gandak and its tributaries. The great southern offshoot from Gosainthan bifurcates to form the third region, the true Nepal, or valley of Katmandu, lying at an elevation of slightly more than 4,000 ft (1,219 m). To the east lies the fourth region, which is formed by the basin of the Sapt Kosi draining the mountain from Gosainthan to Kangchenjunga.

Rivers in Nepal flow mainly from north to south, which means they originate from the Himalayas and flow into the GANGES RIVER in India. The major rivers in the country of Nepal include the Mahakali, Karnali, Bahai, Rapti, Narayani, Bagmati, Kamala, Sapt Koshi, and Kankai.

In the early history of Nepal it is difficult to distinguish fact from legend. Many successive dynasties followed until King Man Deva, in the 5th century established trading links with India and Tibet and en-

riched the country. Little is known of the ancient kingdom of Gurkha, but tradition and legends say that the ruling family descended from the Rajput princes of Udaipur, India. After the conclusion of Anglo-Nepali War in 1815, the strong prime minister of Nepal, Bhim Sen, greatly increased the power of prime minister's office and paved the way for the establishment of the Rana line of hereditary prime ministers.

From about 1850 to 1950, the hereditary prime ministers of the Rana family wielded supreme power under the aegis of titular kings. The Ranas were not progressive; they controlled great wealth, and continuance of their position seemed to rest upon an economically depressed Nepal.

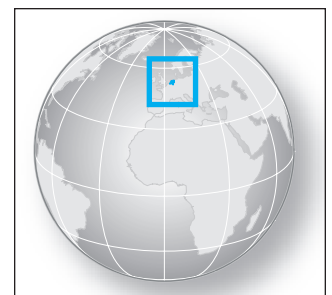
As a result, a palace revolt occurred in 1950, when the king regained his position of authority, and in February 1951, King Tribhuvana's proclamation of a constitutional monarchy ended the reign of the 104-year-old Rana oligarchy. With a new constitution, which came into effect from 1959, many encouraging political developments took place in Nepal; however, economic depression still continues and currently Maoist rebels have taken a political path of armed rebellion.

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## Netherlands

**Map Page** 1131 **Area** 16,033 square mi (41,526 square km)  
**Population** 16,150,511 **Capital** Amsterdam **Highest Point** 1,063 ft (322 m) **Lowest Point** -23 ft (-7 m) **GDP per capita** \$26,900 **Primary Natural Resources** natural gas, petroleum, arable land.



THERE IS A SAYING that God created the world, but the Dutch created Netherlands. Since roughly the 12th

century, the people living at the multiple mouths of the RHINE RIVER have reclaimed over a third of the national territory from the sea, through extensive use of dikes, dams, and polders (drained land). The struggle against the sea concentrated much of the national energy into cooperation and efficiency, resulting in one of the most tolerant and most productive societies on the planet.

The Netherlands—sometimes called Holland, which is actually just one of its 12 provinces—is almost entirely flat. Nearly a third of it is below sea level and requires continual pumping to remove excess water. The region's stereotypical windmills are not merely scenery, but have, since the 15th century, provided the basis for Dutch livelihood and prosperity. Having almost no natural resources, the Dutch instead created one of the largest merchant fleets in Europe, and, at the height of their empire in the mid-17th century, controlled ocean trade from the Caribbean to the East Indies. Raw materials brought back to the Netherlands were processed in ever-growing factories, leading to the development of some of Europe's fastest-growing cities: Amsterdam, Rotterdam, the Hague, Delft, Leiden, and Utrecht.

Today, this cluster of six cities is home to about 7 million people, nearly half the Dutch population, in one of the most densely populated regions of the world. The ports are still among the busiest—Rotterdam is the largest port in the world and has grown in importance through the development of large oil refineries. Canals provide easy transport into the interior of the continent, and it is estimated that 40 percent of all EUROPEAN UNION inland shipping is done by Dutch-owned companies.

Three major European rivers enter the North Sea at the northwest corner of the Great North European Plain: the Rhine, the Maas/Meuse, and the Scheldt. Most of what used to be the Rhine Delta is now canalized and divided into navigable channels. The river's two main channels, the Nederrijn and the Waal flow west into the North Sea, while a significant third branch, the IJssel, flows northward instead, into what used to be the Zuider Zee (South Sea), but since 1932 has been closed off by an immense barrier dam and has been renamed the IJsselmeer (Lake IJssel).

Since then, this large body of water has been slowly drained and reclaimed as massive polders, one of which was recently (1986) named the Netherlands' 12th province, Flevoland. Other polders are being planned for this area. Further to the southwest, the large estuaries of the Scheldt have been secured against flooding by the construction of massive dams, linking



*The Netherlands' capital, Amsterdam, has been a commercial center for centuries, dating back to the Dutch colonial empire.*

together many of the islands of this southwestern province (Zeeland) and shortening the total coastline by 44 mi (710 km). The final dam to be constructed was designed especially to allow the tides to continue to come in but can be lowered in case of flood: a movable dike, considered the world's most expensive insurance policy. It was completed in 1986 and considered a major victory for European environmentalists.

Aside from the historic center of the Netherlands in these western and southern provinces of Holland (North and South), Zeeland, North Brabant, and Utrecht, the Netherlands also consists of its more agricultural eastern and northern provinces. Gelderland,



Overijssel, and Drenthe are more hilly and are home to much of the Netherlands's vast dairy and cheese industries. Most Dutch farms are small, and only 3 percent of the population is engaged in this profession, but the Netherlands is the third-largest agricultural exporter in the world.

The northern provinces of Friesland and Groningen are again very flat and also composed of many polders. The culture is different here from in the industrialized south; it is closely connected to the North Sea region of neighboring GERMANY, and has its own language, Frisian. Frisian is close to Dutch but also shares a strong affinity with Old English. The Frisian Islands—several long, flat, sandy islands, split between the Netherlands and Germany—form a barrier between the North Sea and the mainland. Finally, there is Limburg Province, far to the southeast, with the Netherlands's highest elevations. Limburg has historically had greater ties with Germany and BELGIUM, and was attached to the Kingdom of the Netherlands only in 1839, mostly for strategic purposes, but also for its valuable coal fields.

Administratively, the Kingdom of the Netherlands also consists of a few overseas territories, which enjoy full integrated status as equal partners in the Dutch kingdom: ARUBA and the NETHERLANDS ANTILLES (Bonaire, Curaçao, Sint Eustatius, Saba, and Sint Maarten). These have been autonomous since 1954, Aruba separately since 1986, and, since the mid-1980s have expressed varying degrees of interest in independence. The Dutch government has made clear its goal for independence for these West Indian islands, but at present the status quo continues. Former colonies INDONESIA and SURINAME achieved independence in 1945 and 1975, respectively, but have contributed to the modern cosmopolitan culture of Dutch cities because of large postindependence immigration, especially from Suriname (former Dutch Guiana), where Asians immigrated to Holland rather than face persecution from a black majority.

Aside from coal in Limburg, the Netherlands has few natural resources. There is salt in the far eastern provinces and one of the largest-producing fields of natural gas in Europe, located near Slochteren, in Groningen province. New discoveries of offshore oil have reduced Dutch dependency on Middle East oil but is not enough to supply Holland's numerous large industries. Principal export products include chemicals, plastics, machinery, and electronics, produced by some of the largest global corporations: Phillips, Unilever, and Royal Dutch Shell. For such a small, poorly en-

dowed country, the Dutch economy is one of the strongest—ranked 14th in the world—and Dutch statesmen and businessmen are the leaders of much of today's united Europe.

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## Netherlands Antilles

AN OVERSEAS TERRITORY of the NETHERLANDS, the Netherlands Antilles consists of four and a half islands, separated by about 545 mi (880 km) of the CARIBBEAN SEA. The southern group, Curaçao and Bonaire, known as the Windward Islands, lie 40 to 50 mi (60 to 80 km) off the northern coast of VENEZUELA. Formerly known as the ABC Islands, the A (Aruba) left the group in 1986 and is administered separately. The northern, or Leeward Islands group are the islands of Sint Eustatius and Saba, plus the southern half of the island of St. Martin (Sint Maarten in Dutch), sandwiched between the British dependency of ANGUILLA to the north and the independent nations of SAINT KITTS AND NEVIS, and ANTIGUA AND BARBUDA to the south and east. The northern part of St. Martin is part of France, as is the nearby island of St.-Barthélemy.

The islands are a constituent part of the Netherlands and have had full autonomy of internal affairs since 1954. The departure of Aruba was mostly due to resentment over dominance in the group by its larger neighbor, Curaçao, but initial plans for independence were scrapped in 1996. Other separatist movements have met with defeat in referenda, most recently for Curaçao in 1993 and for Sint Maarten in 1994. The latter was by a lower percentage than previously (59.8 percent), so there may yet be change to the administrative structure of the five constituent parts of what is known as the Dutch Antilles Federation.

Physically, the two groups are very different. Saba, Sint Eustatius, and Sint Maarten are all considerably more elevated volcanic formations and have about twice the amount of rainfall as Bonaire and Curaçao.



The latter islands are low, barren, and arid (less than 25 in or 63 cm of rain per year) and have more of a desert climate than one would think for the Caribbean—aloe and cacti thrive, plus numerous small herds of goats. But this lack of moisture is also a problem for the southern islands' tourist industry. Large seawater processing stations have been built, a side product of which is salt. Salt was one of the chief attractions for Europeans in the 17th century, and Bonaire is still a major exporter. The tourist industries of both islands benefit from constant sunshine and scant rainfall. Bonaire is also known for its rich underwater life, and its large flocks of flamingos (now protected). Curaçao is known for its characteristic liqueur made from locally grown orange rinds. The southern islands lie outside the hurricane belt, but hurricanes occasionally cause severe damage to the northern group. The most recent case was in 1995, when Hurricane Luis devastated resorts and the island infrastructure on Sint Maarten.

The northern group (sometimes called the 3 S's) are each distinct from each other: Sint Eustatius (locally called Statia) is the poorest, Saba the smallest (only 5 square mi or 13 square km), and Sint Maarten, the most developed. All depend on tourism because they lack any major resources. All were settled by the Dutch in the first half of the 17th century and have been officially administered by the Netherlands since 1816. Yet while Dutch is the official language and the language of schooling, most people on all three islands speak English. Each island has its specialty: Saba's rich underwater life, Statia's historic charm, and Sint Maarten's endless beaches. Saba and Statia are both of fairly recent volcanic origin, while Sint Maarten is part of the older, outer arc of the Antilles (like Antigua) and considerably flatter and drier. Saba has recently created a marine park, circling the entire island, to protect its so far unspoiled underwater environment from increasing traffic of divers. Efforts to increase tourism on Statia have been less successful.

Because none of these five islands was suitable for the establishment of large-scale plantation economies, they became instead centers for trade in sugar, tobacco, cotton, and especially African slaves. In the 18th century, Sint Eustatius and Curaçao were two of the biggest marketplaces for slaves in the entire Caribbean. Merchants, pirates, and administrators from all over Europe settled in the major Dutch port of Willemstad, on Curaçao, which led to the development of that island's unique trading language, Papiamentu, a mixture of Portuguese, English, Dutch, and Spanish, still used

by most residents. The abolition of slavery in 1863 in all Dutch colonies hit the islands hard, especially Sint Eustatius, which still today has one-fourth the population it had in the 18th century. Curaçao and Aruba were given a boost with the discovery of oil in nearby Venezuela in the early 20th century and the building of an oil refinery by Royal Dutch Shell on Curaçao in 1917 (one of the largest in the world). Oil formed the backbone of the local economy until the 1980s, when Venezuela opened its own refineries. The Dutch government bought the refinery on Curaçao to prevent it from closing and now leases it to the Venezuelan state oil company. Tourism is most important on Curaçao and Sint Maarten, both of which are lined with resorts for visitors, mostly from America and Venezuela. Duty-free shopping plazas are an additional lure in Willemstad, along with offshore banking, which first developed on the islands in World War II, during the occupation of the Netherlands by Nazi Germany.

### TOURISM BOOM

Sint Maarten, the driest and flattest of the northern group, held little interest to European colonial powers, save as a source of salt because of the extensive salt ponds on the southern and western ends of the island. Peaceably divided between the Netherlands and France since 1648, the island was mostly ignored by outsiders until the tourism boom of the latter years of the 20th century. The population of the island has mushroomed, from about 1,500 on both sides of the island in 1950, to over 33,000 today in just the southern half. But duty-free zones and limited customs controls have caused the Dutch government concern over trafficking in drugs, weapons, and even people, as illegal immigrants attempt to take advantage of the numerous cruise ships that stop here (and in Curaçao) daily.

Willemstad is the largest town in the Netherlands Antilles (population 140,000). Other towns are Kralendijk on Bonaire and Philipsburg on Sint Maarten. The main towns of Saba and Sint Eustatius (The Bottom and Oranjestad, respectively) are much smaller. The Bottom has only 350 residents. About half the population is black (except on Saba); the population of Curaçao retains a significant degree of Amerindian (Arawak) blood, more than most other islands in the Caribbean.

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## Nevada

KNOWN AS THE Silver State, the Battle-Born State, or the Sagebrush State, the mountain state of Nevada was admitted to the Union in 1864 as the 36th state. Covering an area of 110,540 square mi (286,297 square km), Nevada is 485 mi (780 km) north to south and 315 mi (507 km) east to west, making it seventh in size among the 50 states. Nevada has significant areas of land that remain uninhabited and under federal control.

Nevada, which means “snow-capped,” ranks 35th in population. The state is bordered on the north by OREGON and IDAHO, on the east by UTAH and ARIZONA, on the southeast by Arizona, and on the southwest and west by CALIFORNIA. Carson City is the capital of Nevada. The largest cities include Las Vegas, Henderson, Reno, North Las Vegas, Sparks, Carson City, Elko, Boulder City, Mesquite, and Fernley.

Nevada’s arid/semiarid climate results in many days of sunshine broken by minimal precipitation, making it the driest state in the Union. Summers are long and hot, and winters are short and mild. Average temperatures range from a high of 70 degrees F (21 degrees C) in southern Nevada to 45 degrees F (7.2 degrees C) in the northern part of the state. The state’s highest temperature of 125 degrees F (51.6 degrees C) was recorded in 1994 at Laughlin. Annual rainfall is a scant 4 in (10 cm) in drier areas, while other parts of the state may experience up to 40 in (101 cm) each year. Snow may fall at any time of the year in northern Nevada.

### VARIED TERRAIN

Covered with more than 300 mountain ranges and a section of the Mohave Desert, Nevada’s terrain is varied. Most of the state lies within the Great Basin, which also includes parts of Utah, California, Oregon, Idaho, and Wyoming. Geographically, Nevada is divided into the Columbia Plateau, the Sierra Nevada, and the Basin and Range Region. The Columbia Plateau is located in the northeastern section of Nevada, which is underlain with lava bedrock. Over time, water has

shaped this bedrock into the colorful canyons and ridges for which the state is known. As Nevada nears Idaho, the land becomes open prairie.

To the south of Carson City, the Sierra Nevada Region is made up of rugged mountain ranges. Glacier-formed Lake Tahoe is located in one of the valleys of this region. The rest of Nevada falls within the Basin and Range Region, which contains over 150 mountains. Toiyabe and Toquima mountain ranges are located in the central section, while the Snake and Toano are found in the east. Nevada’s other mountains include Boundary Peak, Wheeler Peak, Mount Charleston, and North Schell Peak. Single hills known as buttes and flat-topped mountains called mesas, along with geysers and hot springs, dot the landscape. Soil tends to be thin and alkaline. The highest point in the state is 13,140 ft (4,005 m) above sea level at Boundary Peak. The lowest elevation of 479 ft (146 m) above sea level is located at the southern part of the state at the Colorado River.

Nevada’s principal rivers are the Humboldt, the Truckee, the Carson, the Walker, and the Colorado. Natural lakes are Lake Tahoe, Pyramid Lake, Walker Lake, Topaz Lake, and Ruby Lake. Nevada also has a number of man-made lakes, including Lake Mead, Lake Mohave, Lake Lahontan, and Rye Patch Reservoir.

A land of abundant natural resources, Nevada produces gold, silver, copper, zinc, brucite, magnesium, magnesite, manganese, tungsten, uranium, mercury, lead, titanium, oil, coal, iron, opal, barite, molybdenum, diatomite, talc, gypsum, dolomite, lime turquoise, fluor spar, antimony, perlite, pumice, salt, and sulfur. The state’s major agricultural products include cattle, horses, sheep, hogs, poultry, hay, wheat, corn, potatoes, rye, oats, alfalfa, barley, vegetables, dairy products, and various fruits. Pinon pine, juniper, and fir are the major revenue makers for Nevada’s timber industry. The state’s chief manufactured products are food products, gaming equipment, monitoring devices, chemicals, aerospace products, lawn and garden irrigation equipment, and seismic and manufacturing equipment.

Nevada’s wildlife includes mule deer, pronghorn antelope, bobcat, leghorn sheep, coyote fox, badger, rabbit, porcupine, muskrat, marmot, wild horses, and donkey. Lizards, tortoises, and snakes abound in the desert. Nevada’s birds include thrush, horned lark, Nevada creeper, pheasant, partridge, and sage grouse.

Once known as the divorce capital of the UNITED STATES, Nevada has become synonymous with gambling and entertainment. Millions of tourists flock to

Reno and Las Vegas each year, and Lake Tahoe, on the border with California, has become one of Nevada's biggest tourist attractions.

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## New Caledonia

NEW CALEDONIA IS A French protectorate located in southwestern Oceania, approximately equidistant from AUSTRALIA, NEW ZEALAND, and FIJI. It consists of the principal island, Grande Terre, as well as the outlying Loyalty Islands and their nearby atolls and reefs. Archaeological evidence suggests human settlement dates from approximately 4000 B.C.E. Distinct forms of pottery and imported obsidian objects found in New Caledonia indicate that its early human inhabitants had conquered long-distance ocean travel, and the islanders were part of a broad seafaring civilization prominent in MELANESIA and western Polynesia between 3000 and 3500 B.C.E.

The climate is tropical, with heat and humidity modified by southeasterly trade winds and seasonal typhoons. The terrain of Grande Terre is characterized by sandy coastal plains with rugged interior mountains. These heavily forested peaks cover some 40 percent of the country's land area. The country hosts more than 3,000 indigenous plant species, many of which are seen as potential sources for new pharmaceuticals. Its tropical rainforest is one of the most botanically diverse in the world. There are also some 4,300 fauna species, including unique birds and freshwater fish as well as bats, pigs, and lizards.

The population has traditionally been concentrated along the coast. The ethnically Polynesian and Melane-

sian population first came into sustained contact with Westerners when French Catholic missionaries arrived in 1843. FRANCE established its sovereignty over New Caledonia in 1853. The capital city, Port de France, changed its name to Noumea in 1866. Plans for establishing a French penal colony, similar to Britain's in Australia, were abandoned when it was discovered that the island had substantial deposits of valuable minerals.

The island's hillsides were initially developed as coffee plantations, but mining for nickel soon became the chief industry. The mountainous terrain doomed plantation agriculture, and by the mid-twentieth century animal grazing gained popularity. During the 1950s, labor migrants from Wallis Island came seeking work in the nickel mines and remained as permanent residents.

### FRENCH RULE

After World War II, a modest nationalist movement began to develop. In PARIS, France, however, colonial officials reasserted French authority throughout its colonial empire, including Oceania. A referendum on independence held in 1958 produced an overwhelming popular endorsement of continued French rule in New Caledonia. This result was repeated in a similar referendum held in 1998. Nonetheless there were anti-colonial tensions. A lethal confrontation between native nationalists and French police at Uvea in April 1988 helped change the political situation. French and Caledonian delegates meeting in France signed the Matignon Accords, which granted substantial autonomy to New Caledonia. However, French remained the official language and French mining interests remained largely intact.

New Caledonia's international relations are generally harmonious. Nonetheless, its claims to Hunter and Matthew Islands have been contested. These islands are valued because of their nearby undersea oil fields and seabed minerals. New Caledonia has a multiethnic population, with native residents and those of French descent almost evenly divided at 40 percent of the total. Many minority groups, including Wallisians, Indonesians, and Vietnamese, are also resident in New Caledonia.

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## New Delhi

NEW DELHI, by current estimates, has a population of about 300,000 persons, although Greater Delhi's population is estimated to be between 12 and 14 million, making it the third-largest urban settlement in INDIA. Located at the western side of the Gangetic Plain in India, New Delhi is also located next to the city of Delhi, often referred to as Old Delhi. Both of the cities, however, while being in proximity to each other, have very different histories and urban forms: Old Delhi is an urban sprawl filled with narrow, winding streets, forts, bazaars and mosques; the city was the Muslim center of India from the 17th to 19th centuries, although the origin of the present city begins in the 12th century. New Delhi, on the other hand, is greatly different because of its much shorter history and its urban morphology of a monumental context—broad, straight, tree-lined Baroque-style avenues, large-scale governmental buildings, and open spaces. While Old Delhi may be said to be chaotic in form and life, New Delhi is a place of order. Covering an area of almost 579 square mi (1,500 square km), New Delhi is a vast city in spatial extent.

In terms of its history, New Delhi's origins are closely associated with the rise of the BRITISH EMPIRE in India, the declining power of the Mughal Dynasty, and the British government's decision in the early 20th century (1911) to establish a new imperial capital city in India. The previous capital city was Calcutta in the northeast of the country. In January 1931, New Delhi was inaugurated as the new capital of India.

The task of planning and designing the new city was given in 1912 to architects Sir Herbert Baker and Edwin Lutyens (Lutyens was prominent in the development of the English vernacular house design, and Baker was an architect who had designed widely in colonial SOUTH AFRICA). The city plan of New Delhi is similar in form to 19th-century PARIS and Washington, D.C., having a geometric-shaped urban form dominated by long, wide avenues that lead up to nodes created by significant public buildings or spaces, such as the India Gate, the Parliament Building, and Rashtrapati Bhawan, the

official residence of the president of India, once the British viceroy's house.

The most important of the city's roads is the Rajpath, a monumental boulevard used for ceremonial parades that provides a huge vista toward the former British buildings on the top of Raisina Hill. Architecturally, the grand edifices of the British were designed to explicitly show imperial power, hence classical forms were employed. Despite India gaining independence from the British in 1947, New Delhi's capital status was confirmed by the Indian government in 1950, and with its increasing size and cultural importance, the city was granted state status in 1992.

Today, Delhi, that is, Greater Delhi, is the richest city in India because of it is the economic, trade, and industrial center of northern India. Despite planning restrictions, the last decades have seen a major increase in industrial development; among the most important local products are chemicals, clothes, and electrical and electronic goods. Engineering and banking are also of growing significance.

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## New Hampshire

LOCATED IN THE northeastern UNITED STATES, the state of New Hampshire has a total area of 9,304 square mi (23,380 square km) of land and 277 square mi (23,338 square km) of inland water, with its geographic center lying in Belknap County, 3 mi (5 km) east of the town of Ashland. New Hampshire is bordered on the north by the Canadian province of Quebec, on the east by state of MAINE, on the south by MASSACHUSETTS, and on the west by VERMONT. New Hampshire is one of six New England states (the others being Maine, Massachusetts, Vermont, RHODE ISLAND, and CONNECTICUT). New Hampshire's highest point is Mount Washington, which rises to 6,288 ft (1,918 m) above sea level, and measures 190 mi long by only 70 mi wide. The state's population is 1,185,000. New Hampshire has a small area along the ATLANTIC OCEAN, with the seaport at Portsmouth.



Five of New England's major streams originate in the hills of New Hampshire, which has resulted in the state's being nicknamed the "Mother of Rivers." The Connecticut River rises in its north; the Merrimack River rises in the Franconia Mountains; the Piscataqua River forms at Dover; and the rivers Androscoggin and Saco flow east to Maine, becoming two principal rivers of that state. New Hampshire has some 1,300 lakes and ponds and about 40 rivers.

New Hampshire has a dynamic climate. Its proximity to the ocean and its mountains, lakes, and rivers keep its temperature in almost constant flux. The state experiences all four seasons, with wonderful autumn foliage and long, cold winters. Some of the coldest temperatures and strongest winds ever recorded in the continental United States have been observed in New Hampshire. Spring and summer, on the other hand, are short and cool.

New Hampshire contains many forests, abundant with all types of flora, such as elm, maple, beech, oak, pine, hemlock, and fir trees, as well as rare forms such as the balsam fir, willow, dwarf birch, Labrador tea, and Alpine bearberry. The state is also known for its wildlife. Mammals include white-tailed deer, muskrat, beaver, porcupine and snowshoe hare. Some of New Hampshire's wildlife is endangered, including the bald eagle, lynx, and Atlantic salmon.

New Hampshire's nickname is the "Granite State" because of its many granite mountains. Tourist attractions bring 1 million visitors every year, visiting mountain, lake and seashore scenery. Because of its fertile soil, New Hampshire is also famous for its horticulture, such as apples, strawberries, blueberries and peaches. New Hampshire is known as a socially conservative state with an independently minded populace that reflects its motto, "Live Free or Die."

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## New Jersey

THE STATE OF New Jersey, located on the east coast of the UNITED STATES between NEW YORK, PENNSYLVANIA,

and DELAWARE, is home to hundreds of flora and fauna. The landscape of the state is comprised of pine forests and flatlands in the interior, swampy meadowlands in the north and the dry Pinelands in central and southern portions of the state. New Jersey is located in between the northern and southern region of the United States. The state has a moderate climate, hundreds of miles of coastline, and distinct geographic regions, and it is home to over 500 kinds of animals such as frogs, deer, raccoons, and dolphins.

The state is 166 mi (267 km) long from north to south and the greatest width is 65 mi (104 km) east to west. These dimensions result in a wide variety of weather, but overall, New Jersey has a moderate climate, with cold winters and hot summers; temperatures reach at times over 100 degrees F (38 degrees C) in the summer, and drop on occasions to around 0 degrees F (-18 degrees C) in the winter. In 1524, Giovanni da Verrazano was reportedly the first to visit the New Jersey coast. In 1609, Henry Hudson and his crew landed in New Jersey and explored the undiscovered land. The Dutch West India Company was chartered in 1621, and these merchants created settlements in New York and New Jersey.

In 1664, the land in New Jersey was included in a grant Charles II gave to his brother James, the Duke of York. James gave the land to two of his friends, Lord Berkeley and Sir George Carteret. Carteret was formerly the governor of the island of Jersey off the coast of England. Carteret sent his relative Philip Carteret to lead a group of emigrants to his land, and they created a settlement at Elizabethtown.

Settlers began to arrive from New England and they founded Newark. Carteret formed a government in which religious liberty was granted to all Englishman and more began to arrive. In 1676, the province was divided into East Jersey and West Jersey. These two Jerseys ultimately became united and were placed under the governorship of New York and New England. In 1702, New Jersey became a royal province united with New York. This lasted until 1738, when the two colonies were finally separated.

By 1760, 75,000 people occupied the colony of New Jersey. Almost all were farmers from English descent. As New Jersey, along with the 12 other American colonies, began to protest certain British measures, a rebellion against British rule seemed inevitable. The 13 colonies worked together to stage a joint resistance, and by April 1775, the war for independence was under way. For the next eight years, the colonists in New Jersey witnessed a number of battles on their soil,

including fights in Trenton and Monmouth. George Washington's Continental Army camped out in Morristown in the winter of 1779–80 and marched up and down the colony throughout the war. After an astounding victory against the British in 1783, representatives from New Jersey and the newly freed colonies convened four years later in Philadelphia, Pennsylvania, for the Constitutional Convention. On December 18, 1787, New Jersey ratified the constitution and became the third state in the United States.

Between 1790 and 1820, as the United States grew, New Jersey seemed to develop at an extremely slow pace. The population rose from 95,000 to 227,500 between this period, and its agriculturally based economy lagged behind as the United States entered the INDUSTRIAL REVOLUTION. During the Civil War, thousands of troops from New Jersey fought for the Union. After the war, New Jersey grew at an incredible rate: 1,883,669 people inhabited the state in 1900, and factories increased by 230 percent. Railroads were developed, and Jersey City became a major transportation center. Immigrants began to populate the larger cities, and the face of the state underwent a major transition.

## SUBURBS

After World War II, the American people began to settle into suburbs of major cities. Towns in New Jersey became major suburbs for New York City and Philadelphia. Between 1950 and 1960, the state's population dramatically rose by 1.2 million. Farm owners were selling their land to developers, and homes were built at a staggering rate. New Jersey also became home to a multitude of research centers.

Ethnic groups in the larger cities such as Newark were also changing. Over 130,000 African Americans moved into Newark between 1950 and 1970. Many of these citizens faced unemployment and extremely difficult living conditions. In July 1967, the city of Newark seemed to explode as rioting and burning broke out: 23 people were killed and \$10 million of property was destroyed. Around 23,000 private jobs were lost between 1967 and 1972. Into the 2000s, revitalization projects are occurring in Newark, Jersey City, and Camden, and the shoreline (Atlantic City and its casinos) remains a vacation spot for many.

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## New Mexico

NEW MEXICO IS THE "Land of Enchantment." Nowhere else in the UNITED STATES can such a variety of landscapes, histories, and traditions be found. Located in the American southwest, New Mexico is part of the dry and warm Four Corners region. Although primarily arid in the southern deserts to semi-arid in the high deserts, there are also some pine-studded mountain ranges and High Plains GRASSLANDS. New Mexico is bordered to the north by COLORADO, to the west by ARIZONA, to the south by MEXICO and TEXAS, and to the east by OKLAHOMA and Texas.

The RIO GRANDE flows along a rift valley down the state's center, providing a study of contrasts. From Albuquerque's verdant bosque along the river, one can look east to the snow-capped Sandia mountains or west to dry buttes harboring Anasazi petroglyphs. Capulin, a volcano extinct now for 10,000 years, rises from the ancient beds of this former inland sea. The Malpais (badlands) are lava flows found in several parts of New Mexico. They are difficult to cross because of the rough rock and are often threaded by lava tubes later used by locals for transportation routes or housing. A visitor can climb up the white gypsum sands of White Sands National Monument and gaze at the uniquely blue skies, or descend deep into the Earth to navigate the dark and winding Carlsbad Caverns.

The Rio Grande is not the only wayfinder through this land. Ancient trails of the Anasazi Indians can still be found in Mesa Verde, Chaco Canyon, and the Aztec ruins. Several trails used by Spanish explorers cross several parts of the state, like the old Santa Fe Trail leading from Independence, MISSOURI to the oldest capital in North America (Santa Fe), and the trail leading to Morro Rock where 17th-century explorers carved their names. Along several valleys are old cattle drive trails used to bring Texas and New Mexican cattle first up to the gold miners of the Rocky Mountains and later to the railroads in Colorado for shipment to the east. Interstate 40 parallels the famous Route 66 that once connected Chicago to Los Angeles.

Histories are made of the interplay between cultures and the landscape they occupy. The first inhabitants of New Mexico were the Anasazi, a collective name for the first indigenous peoples who arrived in the area around 200 C.E. By the time the Spanish arrived in the mid-1500s and established Santa Fe as their capital, numerous Indian tribes lived in New Mexico. The Spanish had established a stronghold before the Anglo migrants from the East arrived. Today New Mexico reveals the results of these migrations as the state incorporates the multi-faceted heritage of the many Indian, Latino, and Anglo cultures.

New Mexico proudly celebrates its many traditions. There is Albuquerque's International Balloon Fiesta, the Inter-Tribal Indian Ceremonial near Gallup, Santa Fe Indian Market, Taos Valley Acequia Festival, and Hatch Valley Chili Festival, among others. New Mexico has long been at the forefront of innovation through the Los Alamos and Sandia labs (nuclear research), very large array (VLA) radio telescope (astronomical research), and the White Sands Missile Range (space flight research). The state has a growing information technology industry and is moving to the forefront in wind and solar power research.

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## New York

**NEW YORK**—OFTEN called New York State to distinguish it from **NEW YORK CITY**—is a northeastern state of the **UNITED STATES**, bordering **VERMONT**, **MASSACHUSETTS**, and **CONNECTICUT** to the east; **PENNSYLVANIA** and **NEW JERSEY** to the south; and the Canadian provinces of **Ontario** and **Quebec** to the north. Lakes **ERIE** and **ONTARIO** form the greater part of the boundary between New York and Ontario. Lake Champlain forms more than half of the boundary between New York and Vermont.

New York is roughly triangular in shape, with angles jutting north to Quebec, west to Lake Erie, and southeast toward Long Island. New York's highest point is Mount Marcy, which reaches 5,344 ft (1,629

m) in the Adirondack Mountains of the northeastern part of the state. The total area of New York is 54,556 square mi (141,299 square km), which makes the state 27th in size among the 50 states.

From 1810 through the U.S. census of 1960, New York was the largest state in population. New York's estimated 2003 population totals 19,190,115, approximately 4 out of 10 of whom live in New York City. If New York City's Long Island and northern suburbs are included, almost two-thirds of the state's population lives in the New York City metropolitan area.

New York's capital is Albany; its largest cities are New York City (with a 2000 census population of 8,008,278), Buffalo (292,648), Rochester (219,773), Yonkers (196,086), and Syracuse (147,306). New York State, and in particular New York City, dominates the nation in finance and in the publishing and fashion industries. Agriculture is important to the upstate New York economy, particularly milk production, the growing of fruits and vegetables, and the production of wine. Tourism is of great importance to New York State, with attractions ranging from Niagara Falls to the Finger Lakes, from the Adirondacks to New York Harbor's Statue of Liberty.

New York is the only state to possess shoreline on both the **ATLANTIC OCEAN** and the Great Lakes. The state includes four islands just offshore from the mainland. Fishers Island lies off the Connecticut coast. Long Island, which includes parts of New York City, extends eastward from New York Harbor more than 110 mi (177 km) and separates Long Island Sound from the open Atlantic. The island of Manhattan, including the business and tourist sections of New York City, lies across the Hudson River from New Jersey and across the East River from Long Island. Staten Island, which also comprises a portion of New York City, lies off the mainland of New Jersey, across New York Harbor from Long Island. These islands form part of the terminal moraine deposited by the last of the Pleistocene continental glaciers. The valley of the **HUDSON RIVER**, which flows into New York Harbor at New York City, extends north to the Adirondacks. The Hudson's channel, carved out to form a fjord by the Pleistocene glaciers, is a tidal stream all the way up to Albany, more than 150 mi (241 km.) from the river's mouth.

North and west of the Hudson Valley are New York State's two major mountainous areas, the Adirondacks and the Catskills. The Mohawk Valley, containing the Mohawk River (the major tributary of the Hudson), separates the Adirondacks and Catskills and stretches almost 100 mi (160 km) west from Albany to

the Lake Ontario plain. Southwestern New York is a portion of the Appalachian Plateau, into which the Pleistocene glaciers carved the Finger Lakes, the largest of which are Seneca and Cayuga. Lake Erie empties into Lake Ontario through the Niagara River, which forms part of the Ontario-New York border. The difference between the elevations of these two Great Lakes, together with the large volume of water carried by the river, accounts for a spectacular vertical drop of 182 ft (55 m) at Niagara Falls.

## NEW YORK STATE

Two groups of Native Americans inhabited New York State when the state was first visited by Europeans. Algonquin peoples inhabited the southeastern portions of the state. The Iroquois Confederacy (an alliance of the Seneca, Cayuga, Onondaga, Oneida, and Mohawk) dominated central and western New York. The first European settlement was established by the Dutch near Albany in 1624. This settlement soon became part of the Dutch colony of New Netherland, established in 1626 with the founding of the settlement of New Amsterdam at the southern tip of Manhattan Island. The colony of New Netherland capitulated in 1664 to the British, who changed the name of the city and colony to New York.

New York State played a major role in the American Revolution; the American victory at Saratoga is generally considered the decisive battle of the war. New York State grew rapidly throughout the 19th century, especially after the completion of the Erie Canal through the Mohawk Valley and west to Buffalo in 1825. The canal provided the easiest, most level transportation link between the northeastern states and the rapidly developing Midwest, and the commerce and influence channeled by the canal soon justified New York's "Empire State" nickname. The Erie Canal also prompted other advances that helped link the expanding American empire closer together: the New York Central Railroad, the shipping businesses that grew to become Wells-Fargo, and the telegraph industry (the profits of which would eventually endow Ithaca's Cornell University).

In the 20th century, New York State, in spite of increasing competition from rapidly growing CALIFORNIA and TEXAS, was able to maintain a strong influence over the economic and cultural life of the nation.

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## New York City

"THE BIG APPLE," covering 303 square mi (785 square km), is located at the southernmost point of New York State. It is bounded to the north by Westchester County, to the east by Nassau County, and to the west by the state of NEW JERSEY, across the HUDSON RIVER. The city is comprised of five counties, known as boroughs: Manhattan (New York County), Brooklyn (Kings County), Queens (Queens County), Staten Island (Richmond County), and the Bronx (Bronx County). Each county has a diverse geography and history. All boroughs except for the Bronx are either islands unto themselves (Manhattan and Staten Island) or part of islands (Brooklyn and Queens). Manhattan is 13.4 mi (21.6 km) long and 2.3 mi (3.7 km) wide at its widest point and is located between the East River on the east side and the Hudson River on the west side. The northern reaches of Manhattan are separated from the Bronx by the Harlem River. In total, New York City has 578 mi (930 km) of waterfront.

Most of Manhattan island is near sea level and relatively flat. Uneven terrain used to mark much of the island, but as development continued, the land was flattened. The northernmost tip of the island is hilly and contains Fort Tryon Park and Inwood Hill Park. The bedrock of Manhattan makes it excellent for the deep foundations needed to construct major skyscrapers. This bedrock is closest to the surface in midtown Manhattan and again in downtown Manhattan, explaining the lack of very high skyscrapers between 14th Street and the Wall Street area.

New York City was the site of the terminal moraine during the last Ice Age; the southernmost point to which the glaciers advanced. New York City owes many of its geological features to these advancing and receding glaciers. Though it is the most populous city in the United States, New York has an impressive amount of parkland. The 840-acre (340-hectare) Central Park was created in the mid-19th century in the middle of Manhattan by the architects Fredrick Law Olmsted and Calvert Vaux. Completion of the entirely man-made park involved the planting of 5 million trees



and the creation of numerous lakes and ponds. Other major parks include Prospect Park in Brooklyn, and Forest Park in Queens. An intricate aqueduct system brings potable water to the city from reservoirs in the Catskill Mountains.

The original area of Manhattan Island was smaller, but over the course of the years demand for prime real estate caused landfill to be added to create a wider lower Manhattan. Water Street, on the east side of the island, was originally right on the water but is now two blocks inland. Battery Park City, on the west side of the island, is also on landfill. A 70-acre (28-hectare) fresh-water body called the Collect Pond was filled by the early 18th century. The northernmost part of central Queens was also landfilled to create Flushing Meadows Park, site of the 1939–40 and 1964–65 World's fairs. Wildlife is sparse in the city, but the manmade Jamaica Bay Wildlife Refuge in southern Queens harbors many species of birds. The least populated borough, Staten Island, is also the hardest to reach. It is accessible from Manhattan by ferry or from Brooklyn by the Verrazano-Narrows Bridge. One of the largest airports in the country, Kennedy International Airport, is located in southern Queens.

Manhattan is a destination for many tourists from around the country and around the world. Attractions include the Empire State Building, the Theater District (Times Square), historic South Street Seaport, Macy's Herald Square (the world's largest department store), the Statue of Liberty, and numerous museums including the Metropolitan Museum of Art. One of the nation's most prestigious universities, Columbia, is located in northern Manhattan; dozens of other colleges and universities are located throughout the city, including New York University and the exclusive Cooper Union, an engineering school.

Manhattan and the outer boroughs are connected by several bridges and tunnels. Manhattan and New Jersey are connected by the Lincoln Tunnel and the George Washington Bridge. Numerous rapid transit lines (including subways and commuter railroads) also cross under the East and Hudson rivers, transporting commuters to and from the suburbs as far away as southern New Jersey and Connecticut.

Manhattan's rich heritage is evident in its many different neighborhoods with distinct geographies and traditions. Some of the best known and most colorful include Greenwich Village, TriBeCa (triangle below Canal Street), SoHo (South of Houston Street), Chelsea, Hell's Kitchen, Little Italy, and Chinatown. Different neighborhoods have been trendy over the

years. For example, Greenwich Village has nurtured numerous artists and writers during the 1950s and 1960s. In the outer boroughs, present-day neighborhoods such as Flushing and Jamaica were actually separate towns until consolidation with Manhattan.

Most of Manhattan's streets were designed in a numbered north-south grid pattern, called the Randall Grid, that was first developed in the early 19th century. South of 14th Street, the street layout is more irregular. In the Wall Street area at the southern tip of the island, the streets are exceptionally narrow and winding.

In 1524, the Italian explorer Giovanni da Verrazano, sailing from Europe, discovered New York harbor. The explorer Henry Hudson sailed up what is now the river that bears his name in 1609. An explorer named Adrien Block spent about six months on the site of the future city when his ship caught fire and was destroyed, but the first permanent settlers did not arrive from Holland until 1625. By 1628, there were about 270 people living in the settlement, then known as New Amsterdam. The four other boroughs were also



*New York City's five boroughs are known as: Manhattan, Queens, Brooklyn, the Bronx, and Staten Island.*

settled during the 1600s, by Dutch and English colonists.

Violence broke out between Manhattan settlers and the local Native Americans in 1643. In 1653, the Dutch built a protective wall across the island at the site of what is now Wall Street. Other surviving street names are indicative of the Dutch era; Beaver Street is named after the animal that fur traders sought in the 17th century, and Beekman Street is named after an early Dutch mayor of the city. In 1664, several English warships sailed into New York harbor and peacefully took over the city. The city was briefly restored to Dutch rule from 1673 to 1674.

By 1700, the prosperous city still looked very Dutch, with numerous step-gabled buildings. Settlement of the city had begun at the southern tip of Manhattan Island and proceeded north. With each passing year, the city limits crept further and further north and farmland was turned into homes. By 1760, the population had reached 18,000. The English occupied the city during the American Revolution. After the war, New York City briefly served as the capital of the nation and the first president, George Washington was inaugurated there.

A great fire in December 1835 destroyed 700 houses and with them the last of the original Dutch buildings. Thanks to Irish and German immigration, the population grew rapidly during the 19th century, from 300,000 people in 1840 to 800,000 people in 1860. During the Civil War, the city's poor revolted against the military draft. Several hundred people were killed in the ensuing riots in 1863.

Ellis Island opened in 1892 to handle the increasingly large volume of immigrants; in 1907 immigration reached its peak of more than 1.2 million people. The outer boroughs were consolidated with Manhattan in 1898 to create Greater New York. The construction of the Brooklyn Bridge in 1883 and the first subways in 1904 made transportation among the boroughs much faster. The population of the city doubled between 1900 and 1930, reaching more than 7,000,000. The completion of the Chrysler Building and Empire State Building in the 1930s and the World Trade Center in the 1970s helped create the most impressive skyline in the United States. The terrorist attacks of September 2001 leveled the Twin Towers and killed more than 2,700 people. Planners soon designed an equally imposing Freedom Tower to stand in its place.

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## Newton, Isaac (1642–1727)

SIR ISAAC NEWTON WAS one of the most famous and influential men in the world of science, in both mathematics and natural philosophy. His laws of gravity and motion formed the basis of classical mechanics, principles that are at the heart of modern engineering, physics, and astronomy. His work provided a mathematical mechanism to prove earlier theories of heliocentrism—the sun-centered system—and allowed later scientists to correctly determine the orbits of planets, comets, and even galaxies. Newton is also known in other areas of science and mathematics for his work on optics and differential calculus.

Newton was born in Woolsthorpe, England, in the rural eastern county of Lincolnshire. He was educated at Trinity College, Cambridge, where he continued as a professor from 1667 until his resignation in 1701. The years just prior to this appointment, however, were among his most productive. During this time he formulated his ideas on calculus, as well as his earliest thoughts on gravity and optics. He analyzed the pull of the planets around the sun, the moon around the Earth, and the pull of the Earth on everyday objects, such as Newton's proverbial apple. From these observations, he was able to calculate the force applied to these bodies or objects, as well as their orbit, velocity, and mass. This eventually led him to conclusions about a universal force applicable to all things, large and small, a force that he named gravity, for the Latin word for weight, *gravitas*.

The relevance of these laws to geographers in particular lies in Newton's theories on the shape of spinning spherical objects (like the Earth), and on the tides.

For the first time, the tides could be mathematically explained through application of Newton's law of universal gravitation.

His first publications were in the area of optics, examining the diffusion of white light into colors of the spectrum through a prism. One of his chief contributions to science was not necessarily in the content of these early publications, but in their presentation, which relied on empirical observations and experimentation alone, rather than mixing them with hypothesis, which had been the accepted practice since the days of Aristotle.

Newton developed a more practical telescope and theorized about the nature of light, considering it to be made up of particles, each affected by gravity. Today, we understand light more as a series of waves, not particles, but the material is again worthy as pure observed data. His system for advanced mathematical calculations, known as the calculus, provided the means for scientists to test and prove ideas that until then existed only as hypotheses. The German mathematician Gottfried Wilhelm Leibniz also created such a system, concurrently and independently, and the credit for the initial idea was heatedly disputed by Newton, and clouded his scientific relationships (and creative output) for the rest of his life.

His work in mathematics and optics quickly became popular among the scientific community and he was named a Fellow of the Royal Society in 1672. It was the publication of his major work in 1687, the *Philosophiae Naturalis Principia Mathematica*, however, that made Newton a household name, not just in England, but across Europe. This was an extension of his first work on the laws of motion, *De Motu Corporum* ("On the Movement of Bodies"), published in 1684.

The *Principia* established the three universal laws of motion that would not be improved upon for the next 300 years. In general, the work is a unification of numerous isolated physical facts developed by previous natural philosophers, but codified by Newton into a satisfying system of laws. The work also presents analysis of the speed of sound in air, and preliminary thoughts on the laws of thermodynamics. There were three reprints of the *Principia* in his lifetime, and numerous others in the centuries to follow. As Newton's fame spread, he was elected president of the Royal Society in 1703, and associate of the French Académie des Sciences. He was knighted by Queen Anne in 1705, and was buried with full pomp and ceremony in Westminster Abbey, England, in 1727.

In addition to his academic career, Newton was also briefly a member of Parliament for Cambridge (1689 and 1701) and served as master of the Royal Mint (1699), in charge of reorganizing the system of British coinage. Newton's work as a scientist cannot be entirely separated from his intense, lifelong passions for both religion and alchemy. He believed firmly that gravity explained the motions of the planets but could not explain who got this motion started. Many of his writings later in life were religious tracts dealing with the literal interpretation of the Bible. Secretly a Unitarian, he disbelieved in the Trinity, so much of this work was published posthumously. As an alchemist, he was very interested in matters of the occult and in ideas of the attraction and repulsion of particles.

The life of Newton overall reflects a fundamental shift in values in Western Europe across the 17th century, the period now known as the Scientific Revolution. Whereas Galileo's work on the movement of celestial bodies had nearly got him burned at the stake in the first third of the 17th century, less than a century later, Newton's work in the same area earned him universal praise.

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## New Zealand

**Map Page** 1127 **Area** 107,737 square mi (268,680 square km) **Population** 3,951,307 **Capital** Wellington **Highest Point** 12,283 ft (3,754 m) **Lowest Point** 0 m **GDP per capita** \$20,100 **Primary Natural Resources** natural gas, iron ore, sand, coal.



IN THE SOUTH PACIFIC OCEAN, the country of New Zealand lies to the southeast of AUSTRALIA. However, while Australia is continental in size and largely desert

(or outback) in landscape, the land of New Zealand consists almost entirely of two islands (unimaginatively named North Island and South Island) separated by the 20-mi- (32-km-) wide Cook Strait. Quite small compared to Australia, about the size of COLORADO in area, New Zealand displays a wealth of landscapes, usually rich in scenic beauty.

South Island is headed by the Southern Alps, a string of mountain peaks running for about 300 mi (500 km). Much of New Zealand was created from volcanic action. The islands lie along the collision lines of tectonic plates (Pacific and Australian). The resulting geologic activity has caused volcanic eruptions throughout New Zealand's history. The North Island retains most of the country's volcanic activity. There, in 1886, Mt. Tarawera's especially violent eruption was heard hundreds of miles away but locally buried the prosperous neighboring village of Te Wairoa. This general region is now known as Rotorua, where continued geothermal activity creates a wondrous and startling landscape. Similar to the geothermal features found in Yellowstone Park in the UNITED STATES, the elements of Rotorua include geysers, mudpots, hot pools, and more. In contrast, the Southern Alps often feature glaciers, most notably the Tasman Glacier.

On both islands the presence of mountains prompts OROGRAPHIC PRECIPITATION, which, coupled with the moist air inherent to the island setting, produces plentiful rainfall throughout nearly all of the country. Many areas are intensely forested, with the western regions of South Island having RAINFORESTS with 80 to 100 in (203 to 254 cm) of rain annually. Only the Canterbury Plain receives less than 30 in (76 cm) of precipitation yearly. As a group of islands, New Zealand abounds in beaches, with 9,404 mi (15,134 km) of coastline.

Because New Zealand climate is mainly an oceanic temperate climate, the far northern reaches are nearly subtropical and New Zealand features very successful commercial agriculture. The kiwi fruit was introduced in about 1900; New Zealand now harvests the fruit in world-leading numbers. Apples and other fruits also are exported, as well as wine produced from New Zealand grapes. Boosted by the advent of refrigerated ships in the 1880s, New Zealand farmers were able to ship dairy products and meat as far as England. Sheep and cattle grazing expanded rapidly, to the current numbers of about 60 million sheep and 8 million cattle, impressive figures for a country whose human population is less than 4 million. Overall, agriculture yields about 30 percent of the country's export earnings. The

industrial and service sectors of the economy have grown rapidly in recent years. An "Australianization" of the economy, via rapid expansion of Australian companies into the New Zealand market, has become a cause of concern for many New Zealanders.

Settled originally by Polynesians, the arrival of Europeans, principally British, prompted accelerated growth of the population. Known as the Maori, the Polynesian sailors reached New Zealand from the north about 1,000 years ago. These early settlers preferred the climate and setting of the North Island, where modern day Maori also tend to live. Official European discovery came in 1642 with the voyage of Dutch captain Abel Tasman. Attempting to reach the great southern land (Australia), Tasman sailed too far south (hitting the island now known as Tasmania) and too far east, reaching New Zealand (FIJI and TONGA too). British settlement was spurred by the voyages of Captain James Cook in the 1760s. British sovereignty was established by the 1840 Treaty of Waitangi, though sporadic conflict with the natives culminated in the British-won Maori Wars of the 1860s. A gold rush during the 1870s brought a surge in the population. Self-rule was granted by the British in 1852, dominion status was given in 1907, and formal independence was established in 1947.

Maori now account for about 10 percent of New Zealand's population. As a modern developed society, New Zealand currently experiences slow population growth of 1 percent annually.

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## Ngorongoro Crater

LOCATED IN NORTHERN TANZANIA, 80 mi (129 km) west of the city of Arusha is the Ngorongoro Crater. This crater is a caldera formed by the collapse of a large volcano in the Great RIFT VALLEY. It is considered to be the largest subsidence crater in the world with a width of over 12.5 mi (20 km). It is the fifth-largest caldera in the world, and of these, it is the



largest inactive, unbroken, unflooded caldera in the world. The rim varies between 7,480 ft (2,280 m) and 8,005 ft (2,440 m) in elevation, and the floor of the crater has an average depth of 2,000 ft (610 m) below the rim. The floor area of the crater covers 100 square mi (260 square km). The crater hosts several thousand tourists per year but has no actual human inhabitants at this time. No one seems to know the origin of the name Ngorongoro though the Maasia, a nomadic people living in the area, say it means “the great or big hole.”

Besides the size of the crater itself, the crater floor has some unique features such as the Ngoitokitok springs that are a year-round hippo bath, two patches of woodland—the Lerai forest and the Laiyanai forest—the Munge River, several fresh and brackish ponds, and just west of the center of the crater, Lake Magadi. This lake is 20 mi (32 km) long and 2 mi (3.2 km) wide and exists thanks to the volcanic springs that feed it. These volcanic springs produce a large amount of carbonate of soda, creating a crust on the lake that is dredged and processed into soda ash to be used in glassmaking. Mainly though the crater floor is a wide grassy savanna.

Ngorongoro is located at the center of the Ngorongoro Conservation Area, making up 3 percent of the area covered by the park. The Ngorongoro Conservation Area was established as a World Heritage site in 1979.

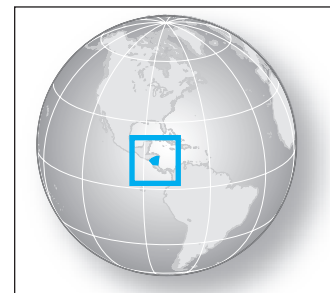
The park is home to approximately 25,000 large mammals, including gazelles, buffaloes, wildebeests, elands, elephants, and the black rhinos. It also has the densest populations of predators out of any of the African parks, made up of lions, leopards, hyenas, and jackals. Lake Magadi and Munge River attract large numbers of greater and lesser flamingos, pelicans, ostriches, grebes, storks, cranes, and more. The first conservator of Ngorongoro, Henry Fosbrooke, considered the Ngorongoro Crater to be the eighth wonder of the world, and many tourists, after visiting, would agree with him.

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## Nicaragua

**Map Page** 1136 **Area** 49,998 square mi (129,494 square km) **Population** 5,128,517 **Capital** Managua **Highest Point** 7,998 ft (2,438 m) **Lowest Point** 0 m **GDP per capita** \$2,300 **Primary Natural Resources** gold, silver, cooper, tungsten, lead, zinc.



**BORDERED** by COSTA RICA and HONDURAS, Nicaragua is the largest country in Central America. The country is divided into three distinctive geographical regions: the Pacific Lowlands, the North-Central Mountains and the Caribbean Lowlands (also known as the MOSQUITO COAST). The Pacific Lowlands is a narrow strip of highly fertile land that is composed of approximately 40 volcanoes. North-Central is mountainous, but the northwestern part of the country includes RAINFOREST. Beyond the western mountain range, the western coast is lined with savannas.

Eastern Nicaragua is bordered by rainforest, lagoons, and swamps, and tropical diseases are common. Two large freshwater lakes, Lake Nicaragua (Lago de Nicaragua) and Lake Managua (Lago de Managua), dominate the southwestern landscape. Lake Nicaragua, which is the more southern of the two large lakes, is the largest freshwater body in Central America. Approximately 20 percent of Nicaragua is arable.

Nicaragua is prone to severe earthquakes, volcanic eruptions and particularly hurricanes. Hurricane Mitch, which struck the Atlantic coast in 1998, devastated the country, killing some 10,000 people, causing catastrophic mudslides, and destroying many bridges and roads. The country has also suffered several volcanic eruptions and a major earthquake since the hurricane, which has made the country slow to recover its economy.

Nicaragua's climate is tropical. The western part of the country is hotter and drier and experiences a rainy season between May and November. The Eastern region is rainy nine months of the year and is subject to hurricanes. Nicaragua's key environment concerns are deforestation, soil erosion, and water pollution.

Among Nicaragua's earliest settlers were the Aztec people, who migrated down from the Mexican lowlands during the 10th century. The Aztec culture remains an influence today. Christopher Columbus is believed to be the first European to see Nicaragua,

when he stumbled across the land during an expedition in 1502. The first European settlers were a Spanish exploratory mission that reached the southern shores of Lake Nicaragua around 1522. Nicaragua became a Spanish colony and remained so until gaining its independence from Spain in 1821. Nicaragua officially became an independent republic in 1838. After its independence, the country was headed by several conservative regimes. In 1934, it fell under the power of a repressive military regime, which held power until 1979, when the Sandinista rebel forces overthrew the military. The country held its first democratic elections in 1994.

Local governance of Nicaragua is divided into 15 administrative departments and two autonomous regions. The autonomous regions are Atlantico Norte and Atlantico Sur. The administrative departments are Boaco, Carazo, Chinadega, Chontales, Esteli, Granada, Jinotea, Leon, Madriz, Managua, Masaya, Matagalpa, Nueva Segovia, Rio San Juan, and Rivas.

Nicaragua is a developing nation. The country is a significant producer of cotton and coffee. There are also moderate gold and copper mining industries located in Nicaragua. However, an estimated 50 percent of the Nicaraguan population lives below the poverty level.

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## Niger

**Map Page** 1113 **Area** 489,191 square mi (1,267,000 square km) **Population** 11,058,590 **Capital** Niamey **Highest Point** 6,634 ft (2,022 m) **Lowest Point** 656 ft (200 m) **GDP per capita** \$800 **Primary Natural Resources** uranium, coal, iron ore, tin.



A **LANDLOCKED** republic in West Africa, Niger is bordered by **ALGERIA** to the northwest, **MALI** and **BURKINA FASO** to the west, **BENIN** to the southwest, **NIGERIA** to the south, **CHAD** to the east, and **LIBYA** to the northeast. Its capital, Niamey, is the largest city; other urban centers are Agadez, Maradi, Tahoua, and Zinder. Niger's climate and terrain rank among the hottest and driest in the world, since four-fifths of the country consists of desert; the remainder is dry savannah. Less than 4 percent of the land is arable. Only one major river, the Niger, runs through the southwest.

Niger's population is largely rural and engaged in pastoralism or subsistence agriculture. The majority of the population lives in the south. The Hausa, Niger's largest ethnic group, are 56 percent of the population, followed by the Djerma (Zarma) at 22 percent, and the Beri Beri (Kanouri) at 4.3 percent. In the northern deserts live the Fula/Fulani, who make up 8.5 percent of the country's population, followed by the Tuareg at 8 percent, with 1.2 percent represented by Arabs, Toubou, and Gourmantche.

Niger is ranked amongst the poorest countries in the world, and is heavily dependent upon foreign aid for basic needs. The country's economy has taken a recent downturn because of the decreasing demand for uranium, which was Niger's largest export.

Neolithic remains have been found in Niger, and the Air Massif was explored by the Romans in the first century C.E. Major trans-Saharan trading states were established from the 11th to the 16th century by the Tuareg (Agadez), the Kanuri (Bilma in eastern Niger), and the Hausa (Zinder.) Much of Niger fell under the control of the Songhai Empire throughout the 15th and 16th centuries; eastern and southern Niger were annexed by Bornu after the fall of the Songhai Empire, and the Djerma settled in southwest Niger in the 17th century.

The Fulani gained control of southern Niger in the early 19th century during the jihad of Usman dan Fodio. The French made Niger a colonial holding in 1885 then established military posts in south Niger, but because of Tuareg resistance, Agadez along with much of the north did not fall under French control until 1904. Niger stayed a colony until the late 1950s, gaining full independence in 1960.

Since independence, Niger has undergone a series of crises. The 1960s saw relative stability despite rebel insurgencies. Niger's economy then plummeted during the Sahelian drought of 1968–75, which destroyed much of Niger's livestock and agricultural resources and prompted a military coup. During the 1980s, the

uranium boom boosted Niger's economy but led to huge disparities in wealth that caused civil unrest. The 1990s saw armed conflict with the Tuareg in the north, several changes to the government, and the assassination of military dictator Ibrahim Baré Mainassara in 1999. France suspended aid to Niger following the assassination, which prompted Niger to hold free elections and create a civil government.

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## Niger River

LOCATED IN West Africa, the Niger River stretches 2,610 mi (4,200 km) in length, making it the third-longest river in Africa, after the NILE and the CONGO. It is ranked 14th among the longest rivers in the world. The drainage basin of the river encompasses 807,000 square mi (2,090,000 square km). The Niger River runs in a long crescent from GUINEA to MALI, right up to the edge of the SAHARA DESERT, before heading south to the Gulf of Guinea.

The unusual course of the river mystified Europeans for many years. The Europeans thought that the section of the river near Timbuktu was part of the Nile River. By the early 17th century, Europeans thought that the river flowed west and joined the Senegal River. Finally, in 1795, Mungo Park became the first European to describe the upper river. While local people knew the actual course of the Niger, Westerners knew about it only through a series of explorations late in the 19th century. The source of the river rises in the Fouta Djallon Highlands at a point near the border between Guinea and SIERRA LEONE, 150 mi (241 km) from the Atlantic coast.

The main source of the Niger River is called the Tembi River. Away from the source but within Guinea, several tributaries join and replenish the Niger. From then on, the Niger traverses the interior plateau in a northeast direction toward the Malian border. As the Niger crosses the border between Guinea and MALI, other rivers such as the Fie join the main channel of water near Kangare, Mali. Thereafter, the Niger flows northeasterly until it reaches the interior delta in Mali.

In the interior the Niger is joined by the Bani River, often regarded as among the important tributaries of the Niger. The Bani River is 696 mi (1,120 km) long and has its source in CÔTE D'IVOIRE and BURKINA FASO.

The Niger is precious to life in Mali. It provides fish, drinking water, and water for farming. It also represents a major means of transportation in Mali, particularly in some of the remote areas in the country. From this interior delta, the river flows in a northeast direction before turning to the southeast to form the great bend.

From this point on the Niger slowly meanders in the arid areas in proximity of Gao (a great center of trade and education during the Mali and Songhai ancient civilizations) and enters the country of NIGER.

While flowing through the country, Niger River is joined by several tributaries such as the Faroul, Dargol, Sirba, Garoubi, and Tapoa. The Niger River then continues and forms the boundary between the Republic of Niger and BENIN. This part of the Niger receives the Mekrou, a tributary from Benin. Thereafter, the river enters the Federal Republic of NIGERIA, where the Benue River joins to create an important confluence of the two rivers at Lokoja in Nigeria. From the confluence with the Benue, the Niger heads southward and discharges through a massive delta into the Gulf of Guinea or the ATLANTIC OCEAN.

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## Nigeria

**Map Page** 1113 **Area** 356,667 square mi (923,768 square km) **Population** 133,881,703 **Capital** Abuja **Highest Point** 7,936 ft (2,419 m) **Lowest Point** 0 m **GDP per capita** \$900 **Primary Natural Resources** oil, coal, tin, palm oil, peanuts, cotton, rubber.



NIGERIA, THE MOST populous nation in Africa, is bordered to the south by the Gulf of Guinea in the ATLANTIC OCEAN, and to the west and east by the Republic of BENIN and CAMEROON, respectively. The Republic of NIGER is across the border in the north. Nigeria's northeast neighbor is CHAD. It is slightly more than twice the size the state of CALIFORNIA.

Nigeria is a tropical country with tropical forests, savannas, mangroves, swamps, and rivers. The Benue and NIGER are the two main rivers in Nigeria. The Niger River flows through the south-central area and forms a large delta to the Atlantic Ocean. There are savannas in central Nigeria, mangrove forests along the coast, and plateaus in the north-central part of the country.

The most important plateau is the Jos Plateau with an elevation of 6,000 ft (1,829 m) above sea level. The far north is characterized by DESERT and some patchy grassland. The climate of Nigeria is hot and humid, though humidity is less than that encountered in the American South.

The Federal Republic of Nigeria is composed of 36 states with a federal capital territory at Abuja. Nigeria was a British colony until October 1, 1960, when it became an independent nation. The people of modern-day Nigeria have a rich history that predates European contacts. They possessed remarkable ancient culture such as the Nok culture, the Yoruba civilization, the Igbo states, and the Ife and Benin civilization. When Portuguese traders and sailors reached the coast of Lagos and the Niger Delta area around 1472, they were surprised to see the people organized, engaging in trade and commerce and displaying their arts and culture. Thus, the first contact was not to trade in humans across the Atlantic; rather, it was for legitimate commerce.

### INTERNAL STRIFE

This soon changed, however, because of internal strife and civil wars among the people, as well as European demand for and encouragement of trafficking in human beings. The Atlantic slave trade, like the trans-Saharan slave trade, was successful because African compradors were willing to cooperate with European merchants. To this group, it was beneficial. The toll on African communities was devastating and perilous. British imperial interests along the west coast of Africa began with the need to stop the Atlantic slave trade, partly to ensure the supply of necessary materials for the emergent industrial factories in England. The British squadron ships patrolled to ensure that no slave

was transported across the Atlantic. By 1851, a consulate was established in Lagos and the Niger Delta area to encourage trade in legitimate commerce. This was the harbinger of British colonial rule in what later became Nigeria.

In 1861, Lagos became a colony, and by 1885 the activities of the United African Company (Royal Niger Company) had paid dividends with the establishment of Oil Rivers Protectorate for the coastal region. A direct administration was not established until consolidation beyond the coastal areas in 1891. And by 1893, the Niger Coast Protectorate was established, which sealed British imperial goals in what later formed the eastern region. The northern part became a protectorate in 1903, giving Britain a greater claim to what later became northern Nigeria.

### FORMING NIGERIA

The name *Nigeria* did not emerge until the amalgamation of 1914 by Frederick Lugard. At the end of World War I, the League of Nations gave German Cameroon to Nigeria as a mandated territory. In 1939, the British divided the Southern Protectorate into eastern and western provinces, with the north remaining intact. Lagos, however, continued to enjoy the benefits of a capital city and administrative nerve center. By 1950, an urban administration was set up to address the growing urban problems in Lagos. With the institution of the mayoral office, Africans were given the opportunity to find solutions to urban problems. Although the mayoral office was canceled in the Lagos colony in 1953, the same office was constituted in Port Harcourt to address urban needs.

Other efforts made were in the realm of constitutional changes and reforms, economic developmental plans, training of junior and senior civil service officials, and other reforms aimed at decolonization. The British did not pursue these efforts as part of a benevolent administrative gesture; rather, they were partly a result of Nigerian anticolonial movements. The leftist groups perhaps played a significant role in British reforms and the pace of decolonization after World War II. With the growing emergence of leftist groups, Marxist literature, and funds from international communist fronts, Nigerian leftist groups were able to make British officials and pro-Western Nigerian nationalist and labor leaders uncomfortable.

Anticommunism thus became an essential part of decolonization, and its success became an ingredient in the eventual transfer of power in 1960. It should not be surprising that postcolonial administration pursued



anti-leftist policies both domestically and internationally. The military interfered in Nigerian politics in 1966 with a coup d'état that overthrew the civilian administration. The country was soon plunged into a civil war in 1967 that lasted for three years. Since 1966, the military has played a dominant role in governance and civil relations in Nigeria.

Although a transfer of power was smoothly ensured in 1979 by the military, the Second Republic (1979–83) did not survive, as the military saw itself in command of development and reforms. The contrary however is the case. The Nigerian military, like most military in the developing world, is allegedly corrupt and contributed to the underdevelopment of the country. Nigeria is, however, experimenting with a Third Republic, which began in June 1999 when the erstwhile military head of state, Olusegun Obasanjo, was elected in a democratic election.

Nigeria has three main ethnic groups: Hausa/ Fulani, Igbo, and Yoruba. The ethnic groups also have some 250 different subgroups and language dialects. Although English remains the official language, there are three main languages represented by the three main ethnic groups. The Hausa/Fulani dominate the northern part, with the Igbo people are in the east, and the Yoruba are in the west. Christianity, Islam, and traditional religion permeate the lives and homes of the people.

While Nigeria is a rich country in terms of proceeds from oil sales, the people are largely poor and marginalized. The benefits from oil profits are not adequately redistributed among the people, nor is it judiciously used in the development of the country. Oil discovery at Oloibiri in 1958, and subsequently in other parts of the Niger Delta area accounts for 95 percent of Nigeria's exports. Although the economy is supported by abundant hydroelectric power, the country has witnessed more blackouts than any third-world nation. There is a growing effort in textile, cement, and automobile industries.

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## Nile River

AT 4,132 mi (6,650 km) long, the Nile River is the longest river in the world. It flows from two principal sources in equatorial Africa that join at KHARTOUM, SUDAN, and continues north through Sudan and EGYPT, emptying into the MEDITERRANEAN SEA. Historically, the Nile has been used in irrigation, farming, and transportation for thousands of years, from the beginning of Egyptian civilization into the 21st century.

The Nile is fed by many tributaries, but ultimately it has two main sources: the White Nile in BURUNDI, and the Blue Nile in ETHIOPIA. Except when swollen by rains in August and September, the Blue Nile contributes less than 20 percent of the water; the White Nile provides the larger share. The ultimate source of the White Nile remained a tantalizing mystery until 1937, when Burkhart Waldecker discovered it while seeking asylum in the Belgian Congo from Nazi persecution in his native GERMANY. Waldecker pinpointed a stream that became the Kasumo River, flowing from Mount Kikizi in Burundi. This river eventually joins the Mukesenyi, the Ruvyironza, the Ruvubu and finally the Nyabarongo River. Also vying for recognition as the source is another small stream from Mount Bigugu that feeds into the Lukarara River and then joins the Nyabarongo.

### WHITE NILE

After the Nyabarongo and Ruvubu rivers join to form the Kagera River, the waters, which will become the White Nile, flow east over Rusumu Falls and then into Lake VICTORIA. The river, now called the Victoria Nile, leaves the lake in the north, dropping over Owens Falls Dam into Lake Kyoga. The river then flows east into the Great African Rift Valley by cascading over Kabarega Falls to Lake Albert. It leaves the lake as the Albert Nile, going north through UGANDA. At the border with Ethiopia the river's name changes again, to Bahr al-Jabal, Mountain River. The Mountain River cascades through highlands before reaching the Sudd, a swampland that brings the waters to a halt, where half the river is lost to evaporation. The marshes and lagoons of the Sudd have existed for millions of years, although the expanse of the Sudd varies depending on seasonal rains and the outflow from the lakes and rivers that feed into it.

After hundreds of miles, the Nile waters emerge from the reservoir of Lake No in the north as the White Nile and join with the Sobat River near Malakal in Sudan. Here it finally takes on the color that gives it its



*The Nile is fed by many tributaries, but has two main sources: the White Nile in Burundi, and the Blue Nile in Ethiopia.*

name, and 500 mi (805 km) later it joins with the Blue Nile. Just 30 mi (48 km) south of Khartoum, the White Nile is dammed into a reservoir by the Jabal Auliya Dam. The original purpose of this dam was to hold back the White Nile during the late summer and fall months when the Blue Nile swelled with rain.

Waldecker's 1937 discovery of the White Nile's source resolved thousands of years of mystery. Greek historian Herodotus had speculated about the Nile's origin in 460 B.C.E. Roman Emperor Nero sought the source during his reign, but the centurions he sent to explore were stopped by the Sudd. Until 1841, the Sudd blocked all attempts to trace the Nile, but in that year an Egyptian expedition did pass through the

swampland. Over the next century, many explorers failed and some died attempting to trace the Nile.

### BLUE NILE

The Blue Nile's source is a stream issuing from Mount Gish in Ethiopia called Sakala. The stream is considered sacred and develops into a river named Little Abbai. This feeds into the southern end of Lake Tana, and Great Abbai, the Blue Nile, flows south out of this lake to drop 150 ft (46 m) from a naturally occurring lava dam and form the Tisisat Falls (the name means "Smoking Waters"). From this point, the Blue Nile makes a wide semicircle and turns east, then north through Sudan. Many rivers feed into it: the Didessa, Dabus, Beles, Dinder, and Rahad among them; some of the rivers contribute water seasonally.

The Blue Nile swells in late summer from heavy rainfall. Dammed in several places, the Blue Nile provides irrigation for the Gezira Plain in Sudan. After leaving Lake Tana, the Blue Nile meets the White Nile at Khartoum, at a place called the Mogren, meaning "the meeting" in Arabic. James Bruce of Scotland found the source of the Blue Nile in 1770 and was appointed governor of Sakala by Ethiopian Emperor Tekla Haymanot II. The Ethiopians had long been aware that their sacred spring was the source of the Blue Nile; a visiting Spanish priest wrote about being shown the source of the Nile in 1615. Bruce was not believed in Europe when he announced his discovery, but his published works detailing his journey were verified by later explorers.

From Khartoum, the Nile flows north. Six sections of rapids, called cataracts, mark it; the first is at Sabaqua, 50 mi (80 km) from Khartoum. The northernmost, or first, cataract is at Aswan.

The Atbara River, another major tributary of the Nile, joins the river between the fifth and sixth cataracts. Like most of the other waters contributing to the Nile, the Atbara comes from Ethiopia, where summer monsoonal rains cause the waters to peak in August in September; the waters drop to lower levels from December through April. Coming from the tablelands, the waters that join the Nile carry rich alluvial sediments that for 8,000 years flooded into the farmlands along the banks of the Nile. The original name for Egypt, in fact, was Kemet, the same word used to describe the black silt deposited by the Nile.

### ASWAN DAM

The Nile Waters Agreement of 1959 was negotiated between Egypt and Sudan; Ethiopia, RWANDA, and Bu-

rundi were excluded. This agreement divided riparian rights to the Nile between the two negotiating countries, and cleared the way for the building of a new Aswan Dam. From 1959 through 1970, the Soviet Union financed the construction of the hydroelectric Aswan High Dam. To provide power for the construction, the old Aswan Dam was electrified and equipped with turbines to generate up to 1.8 million kilowatts. By the time it officially opened in 1971, the dam had formed Lake Nasser, which is called Lake Nubia in Sudan. The lake, a reservoir holding up to 162 billion cubic meters of Nile water, is 8 mi (13 km) in width and over 300 mi (483 km) long.

The Aswan High Dam controls the annual flooding of the Nile and supplies electricity for Egypt, but it has created problems as well. The new reservoir displaced 50,000 Nubians initially. Its weight creates instability on local fault lines in the Earth. The dam traps sediments that would be delivered to farmlands in Egypt, and silt that would replenish the Nile Delta, which is now eroding. Trapped behind the dam, the sediments produce algae that destroys oxygen in the lake.

The Nile provides waters to over 250 million people; that figure may double by 2025. While the population of countries fed by the Nile grows by about 3 percent a year, the waters do not increase. Evaporation from Lake Nasser claims 10 billion cubic meters of water yearly, roughly 9 percent of the average annual flow of the Nile into Aswan.

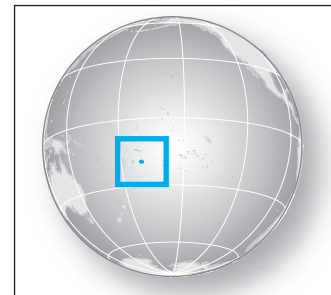
Another major and controversial flood control project on the Nile, the Jonglei Canal in Sudan, was begun in 1978 to circumvent the Sudd marshes. This idea had first been proposed by William Garstin, a British hydrologist, in the early 1900s. Construction stopped in 1983 due to civil war and has never been completed.

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## Niue

**Map Page** 1125 **Area** 100 square mi (260 square km) **Population** 2,145 **Capital** Alofi **Highest Point** unnamed hill near the town of Mutalau 223 ft (68 m) **Lowest Point** 0 m **GDP per capita** \$3,600 **Primary Natural Resources** agriculture.



ONE OF THE WORLD'S largest coral islands and smallest countries, Niue is about the size of metropolitan District of Columbia in the UNITED STATES and has a population the size of a small town. It has a rugged coastline with high limestone cliffs and a grassy interior plateau. Niue is located 1,491 mi (2,400 km) northeast of NEW ZEALAND, on the eastern side of the INTERNATIONAL DATE LINE and is 11 hours behind Greenwich Mean Time. Most of the population lives in 13 small settlements found along a 41-mi (67-km) road that circles the island.

The island is dotted with limestone caves and is without streams or rivers. Rain water filters through the porous limestone out into the ocean with little silt run-off. This allows the surrounding ocean to be crystal clear with dive visibility often up to 229 ft (70 m). Niue lies in the zone of the southeast tradewinds, giving it a tropical climate with temperatures averaging 75 to 80 degrees F (24 to 27 degrees C) year-round. Niue's isolated location and cultural and linguistic differences have enabled it to maintain independence from other Polynesian islands despite its minuscule size. However, a lack of employment opportunities has caused its population to continue to drop from a peak of 5,200 in 1966 to about 2,100 in 2002 with substantial emigration to New Zealand.

Niuean folklore tells of the first settlement of Niue by forefathers Huanaki and Fao, together with fire gods from Fonuagalo, or the "Hidden Land." Anthropologists say Polynesians voyaging by outrigger canoe settled on Niue from TONGA, SAMOA, and Pukapuka Island and called the island Motusefua. The English navigator James Cook, sighted Niue in 1774 but was refused landing three times by warriors in canoes. Cook departed but claimed the island for the UNITED KINGDOM and named it Savage Island. Missionaries from the London Missionary Society established Christianity in 1846. Niue chiefs gained British Protectorate status in 1900, but in 1901 Niue was annexed to New

Zealand. In 1974, Niue gained independence in free association with New Zealand. The people of Niue enjoy dual citizenship and are bilingual, speaking both Niuean and English.

Niue's economy reflects its geographic isolation, few natural resources, and its tiny population. Most residents are subsistence farmers with some cash crops grown for export. Employers include several small factories that process passion fruit, lime oil, honey and coconut cream. Sales of stamps and commemorative coins to foreign collectors are important sources of revenue. Government expenditures regularly exceed revenues, and the shortfall is made up by grants from New Zealand to pay public employees. Economic aid from New Zealand in 2002 was about \$2.6 million.

The official languages are English and Niuean, a Polynesian language closely related to Tongan and Samoan. The predominant religion is Ekalesia Niue (Niuean Church—a Protestant church closely related to the London Missionary Society).

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## Norfolk Island

NORFOLK ISLAND, AN AUSTRALIAN territory, is located in the south PACIFIC OCEAN, 1,041 mi (1,676 km) northeast of Sydney, AUSTRALIA. With a total land area of 13 square mi (35 square km), the island is slightly larger than the District of Columbia; it is approximately 5 mi (8 km) in length and 3 mi (5 km) in width. The highest point on the island is Mount Bates at 1,047 ft (319 m) and the lowest is the Pacific Ocean beach at 0 m. Norfolk Island's terrain is rough with volcanic formations and some plains. The climate is subtropical with little seasonal change. The capital is Kingston; the other major towns are Cascade and Burnt Pine. Norfolk Island is an external territory of Australia and includes the small islands of Nepean and Philip Island to its south.

The population of Norfolk Island is estimated to be 1,853 (2003), with almost 64 percent of the people between the ages of 15 and 64. The primary economic activity is tourism, which has increased in recent years to

such a point that the small island population enjoys a high level of prosperity. While most finished products must be imported, Norfolk Island has achieved a level of self-sufficiency in some foodstuffs, notably poultry, beef and eggs. Other agricultural products include Norfolk Island pine seed, Kentia palm seed, cereals, vegetables, and fruits. Principal export revenue is acquired through the sale of postage stamps to collectors, and the Norfolk Island and Kentia seeds. Norfolk Island has one airport, no railroads, and a limited network of paved roads; communications with Australia have improved during the last decade as a result of satellite networks.

Captain James Cook is credited with being the European who discovered Norfolk Island in 1774. Named after the Duke of Norfolk, this island became a possession of the Australian colony of New South Wales in 1788. During the late 18th and early years of the 19th century, Norfolk Island served as a penal colony. In the 1850s the descendants of the HMS *Bounty* mutiny were forced to relocate from PITCAIRN ISLAND to Norfolk Island.

In 1914, Norfolk Island became a territory of Australia. The current constitution of Norfolk Island was adopted in 1979 and is based on Australian, Norfolk, and British law.

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## North American Free Trade Agreement

IN 1993, THE UNITED STATES, CANADA, and MEXICO signed the North American Free Trade Agreement (NAFTA), which created a regional free trade zone that lowered tariffs and trading restrictions and encouraged greater opportunities for cross-border investments and movement of goods and services between the three



countries. The agreement went into effect in 1994. While all three states had well-established trading relations, a new arrangement was deemed necessary, in part, as a reaction to a similar economic initiative proposed by the European Community (EC). It was also part of the liberalizing trend in international trade, which has driven international economics since World War II.

In 1944 and 1945, representatives from the Allied nations met at the NEW HAMPSHIRE resort of Bretton Woods to establish new international organizations that would regulate and systematize the international economic order. The first effort was the International Bank for Reconstruction and Development and the International Monetary Fund to aid in the development and stabilization of international currencies. Part of the proposed economic structure addressed the rampant economic nationalism that had pervaded trade in the 1930s and that was believed to have contributed to the deterioration in international relations that had led to the outbreak of the World War II.

In 1947, representatives from 23 states met in Geneva, SWITZERLAND, to establish the General Agreement on Tariffs and Trade (GATT), which provided a framework to promote multilateral international trade and development, and thereby limit the threat to the international order of economic nationalism. GATT did not establish an organization that centralized trading agreement; rather it specifically encouraged multilateral free trade agreements, and was strongly supported by the United States. Since its signing, GATT has undergone several additions, the latest being the Uruguay Round in 1995 that established the World Trade Organization (WTO), which adjudicates free trade disputes.

Since GATT was signed, several regional (multilateral) free trade zones have been established. One of the first was the European Economic Community (EEC), later known simply as the European Community (EC); it was created by West GERMANY, FRANCE, ITALY, BELGIUM, and LUXEMBOURG in 1957 to facilitate trade among its membership. The EC expanded to 15 nations as the EUROPEAN UNION and in 1993 became a single free trade market with a common currency, eliminating trade and fiscal restrictions and allowing for the internal movement of goods and services. Growing concern among European trading partners, particularly Canada and the United States, and later Mexico, spurred an effort to form a similar agreement between the United States and Canada.

The first step in the formation of NAFTA occurred in the late 1980s, when the United States and Canada

signed a comprehensive trade agreement, the Canada-United States Free Trade Agreement (CUSFTA) to compensate Canada and the United States for any potential lost market share from the EC policy. The CUSFTA expanded on an earlier agreement that covered autos. Then in 1990, at the request of Mexico, a larger free trade agreement was proposed among the United States, Canada, and Mexico. NAFTA gradually phased out the bilateral CUSFTA terms, as well as preexisting quotas, tariffs, and investments, enlarging the market and labor available to American, Canadian, and Mexican trade.

NAFTA required the three members to eliminate their respective trade barriers and restrictions to cross-border movement and transportation of goods and services, establish a framework for the extension of NAFTA to other regional members, such as a potential free trade agreement for the hemisphere, and provide for increased investment opportunities, thus combining trade and economic policies. The main benefits to the members are cheaper consumer goods, greater investment opportunities, and increased jobs as a result of trade. Removing tariffs forces industries to become more efficient and productive, thereby lowering costs. NAFTA is also intended to help international development by spurring industrial growth in Mexico and, it is hoped, a stronger middle class, while creating higher-paying, high-technology and white-collar jobs in the United States and Canada.

There are, however, several problems with NAFTA. First, energy remains regulated and not subject to free trade. Labor unions criticized the agreement for outsourcing jobs to Mexico, where there are lower labor and environmental regulations and workers' wages. A larger issue, however, is the misuse of the rules of origins, which allow members to declare certain goods not to be subjected to NAFTA because of the presence of nonmember components. Finally, NAFTA has hurt nonmember economies, especially in the Caribbean and South America.

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## North Atlantic Treaty Organization

AT THE END OF World War II (1939–45), Europe lay in wasted ruin with most industrial and transportation infrastructure damaged or destroyed. Some 40 million deaths had occurred in Europe and RUSSIA in the six years of conflict. Approximately 25 million displaced persons were stranded far from original homelands with little resources. The UNITED STATES and its allies were eager to return to a national lifestyle of peace and sought to rapidly demobilize the vast military might they had built up over the years of the war. Men in uniform wanted to return to jobs, education, and opportunities and those at home yearned for the hard won fruits that victory was promised to bring. The scars of war were evident across the landscape of Europe and the human costs of death, disruption, and dislocation cut deep into the heart of every nation. The Soviet Union declined to demobilize and decided to maintain the vast armies and military might that had occupied Eastern Europe and portions of Central Europe.

Efforts by the Allies of WWII to address the rebuilding and reorganization of Europe soon polarized. The Soviets encouraged government changes in areas they occupied to follow socialist or communist patterns. In the west, America, Britain, and FRANCE supported a return to democratic forms of government. Within the areas of Soviet influence, imposition of pro-Soviet undemocratic forms of government became the norm. By the end of 1947, Polish elections had been canceled, the elected prime minister of BULGARIA was forced out of the country, and the People's Republic of ROMANIA was formed. A call to worldwide communist revolution stirred fears of aggression from without and subversion from within.

Soon after the conclusion of the war, as Europe struggled to recover, political events boded ill for a lasting peace. The Soviets made demands of NORWAY, GREECE, and TURKEY that were seen by Western Europe as direct threats to these nations' sovereignty. BELGIUM, France, LUXEMBOURG, the NETHERLANDS, and the UNITED

KINGDOM joined in the Brussels Treaty of March 1948 to build a mutual system of defense against ideological, political, and military threats to their national futures. The Soviet Union began a blockade of Allied-occupied Berlin in April 1948. Civil war in Greece and the elected government of Czechoslovakia's overthrow in a communist coup in June 1948 set an ominous backdrop.

Within a span of three decades, the United States had chosen to come to the aid of Europe in two major world conflagrations without any treaty obligations to do so. Now America was financially and politically committed to the rebuilding of Europe through the European Recovery Plan (Marshall Plan). The perceived threat of the Soviet Union moved the Western European nations and the United States to formalize their security relationship in the Treaty of Washington signed on April 4, 1949.

### FORMATION OF NATO

This, in effect, was the formation of NATO, the charter members being Belgium, CANADA, DENMARK, France, ICELAND, ITALY, Luxembourg, the Netherlands, Norway, PORTUGAL, the United Kingdom, and the United States. The treaty committed the 12 nations to collective defense, meaning that an attack on one was like an attack on all. The North Atlantic Treaty Organization was seen as assurance against military conflict among the agreeing parties, a check to any aggressive German military resurgence, and a clear counter to the military power of the Soviet Union.

The early years of the NATO alliance were characterized by its growth as an institution, delineation of roles and responsibilities, and integration into the military establishments of the governments of Western Europe. The combined military strengths of the NATO nations were quantitatively inferior to those of the Soviet Union concentrated in Central and Eastern Europe. Consequently, NATO's nuclear weapons capability became a central component of its military and political strategy of deterrence and containment.

NATO expanded in 1955 by allowing the re-armed Federal Republic of GERMANY (West Germany) to join. The Soviet Union saw this as an overt threat to their security and countered by organizing a treaty organization of their own. The Warsaw Pact was signed by ALBANIA, Bulgaria, Czechoslovakia, German Democratic Republic (East Germany), HUNGARY, POLAND, Romania, and the Soviet Union. Now all the actors were assigned for this increasingly dramatic play of international tensions. In 1956, a popular uprising against the



*The expansion of the North Atlantic Treaty Organization (NATO) into Central and Eastern Europe with the membership of the Czech Republic, Hungary, and Poland ties the new identity of NATO to the new identity of Europe.*

communist government in Hungary was quelled by invading Soviet forces. The United Nations condemned this response, but NATO took no actions.

In the 1960s, tensions grew in Europe with the building of the Berlin Wall and NATO began to publicly debate the requirement of NATO having direct control of nuclear weapons in the European theater. It was felt that this increased capability and responsiveness would add to the deterrence available to check Soviet-sponsored aggression. After the Cuban Missile Crisis between the United States and the Soviet Union, the Americans gave command and control of nuclear capable forces stationed in Europe to NATO. In 1966, France removed its forces from the military structures of NATO, citing the dominance of the United States in the organization. NATO continued to set the pace for Western military strategy and devised a "First Use" policy, which warned that NATO held the right to use nuclear weapons in response to a conventional military attack against any of its member states.

The 1970s saw a time of détente between east and west. The Strategic Arms Limitation Talks (SALT) produced treaties that called for the drastic reduction of nuclear stockpiles. NATO played a critical role in the

implementation of agreed-upon conventional forces reductions brought about by the Conference on Security and Co-operation in Europe. The end of that decade saw the Soviet invasion of Afghanistan and a renewed interest by America to match Soviet actions with increases in military readiness, capability, and deployment. NATO sponsored the deployment of nuclear ballistic and cruise missiles into Europe.

During these times of increased military activity and general angst, Ronald Reagan and Mikhail Gorbachev began a series of summits that changed superpower relations and opened the door to significant arms reduction talks. NATO again became a major implementing agency of these agreements and other confidence-building measures.

The late 1980s saw the collapse of Eastern European communist regimes as the Soviet Union withdrew military support and Gorbachev encouraged them to seek political and economical reforms. Long-term economic failures and the overall shift in political climate caused change to sweep across Soviet-dominated Europe. NATO takes credit for acting as a continuous deterrent to Soviet military aggression that finally allowed the breakaway of Eastern Europe and perhaps

even the break up of the Soviet Union. The west declared victory in the Cold War as the former Soviet Union dissolved in 1991.

The decade of the 1990s saw vast political change in Central and Eastern Europe and the demise of the Soviet Union. Having watched its rivals dissolve, NATO now faced a redefinition of its role and responsibilities. Interim steps were taken to engage the former Warsaw Pact nations through the Partnerships for Peace program, which developed military relations with former adversaries. As Yugoslavia broke up into smaller republics ethnic violence erupted. NATO took on its first ever combat operations as it worked in line with United Nations (UN) resolutions to create conditions for peace in Bosnia by bombing Serbian military forces. NATO nations provided forces for UN-sponsored peacekeeping forces in the former Yugoslavia.

The defining of new roles for NATO continued into the new century. The terrorist attacks on the United States in 2001 were considered an issue of mutual defense and NATO elected to join America in its war against terrorism embodied in the invasion of Afghanistan. However, as the United States prepared to invade Iraq in 2003, Germany and France blocked all efforts made to gain the political and military support of NATO for the U.S.-led coalition operation. NATO took over command and coordination of the security in and round Kabul, AFGHANISTAN, in August 2003. This is the first mission outside the Euro-Atlantic area in NATO's history, and it raises new questions and concerns as to future of the organization.

### TRANSATLANTIC LINK

NATO holds to its central concept that it embodies the transatlantic link of Europe's security and prosperity. It is the concrete expression of the ideal that the security of North America is permanently tied to the security of Europe. The expansion of NATO into Central and Eastern Europe with the new membership of the CZECH REPUBLIC, Hungary, and Poland ties the new identity of NATO to the new identity of Europe. What path that will take is unclear and the outcome remains uncertain.

NATO continues to operate a robust organization that provides an unprecedented forum in which members can raise issues of concern regarding their security. It also maintains an institutional structure that supports consultation and cooperation between members in political, military and economic, as well as scientific and other nonmilitary fields.

For the foreseeable future NATO will continue to act as an intergovernmental agency that seeks to main-

tain integrated combined military capability to prevent war, manage crisis, and promote security cooperation in Europe and abroad.

NATO's structure consists of a military and civilian component. The civilian side has four primary components. The North Atlantic Council constitutes the executive body of NATO and is formed by permanent representatives from all members. Decisions reached must be unanimous. The Defense Planning Committee is a consultative body that focuses on development of military plans, it includes permanent members from all member nations except France. The Nuclear Planning Group is comprised of national defense ministers. The Secretary General is appointed by member states and acts as the Chair of the senior committees.

NATO's military structure is built on three area-focused commands. Allied Command Atlantic, Allied Command Europe, and Canada-United States Regional Planning Group share the military responsibilities. The United States provides the NATO Supreme Commander.

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## North Carolina

KNOWN AS BOTH the Tar Heel State and Old North State, North Carolina was part of colonial America. Like its sister state SOUTH CAROLINA, North Carolina was named for Kings Charles I and Charles II of England. North Carolina is bounded on the north by VIRGINIA, on the south by South Carolina and GEORGIA, on the west by TENNESSEE, and on the east by the ATLANTIC OCEAN. The total area of North Carolina is 52,669 square mi (136,412 square km), making it the 29th state in size. North Carolina ranks 11th in population among the 50 states. North Carolina's largest cities are Charlotte, Raleigh (the capital), Greensboro, Durham, Winston Salem, Fayetteville, Cary, High Point, Wilmington, and Asheville.



North Carolina has 3,826 square (9,909 square km) of inland water, and the North Carolina coast runs for 301 mi (484 km). Elevation in the state ranges from 6,684 ft (2,037 m) above sea level at Mount Mitchell, which is the highest point in the eastern section of North America, to sea level at the Atlantic Ocean. The state is approximately 500 mi (804 km) east to west and 150 mi (241 km) miles north to south. North Carolina's major rivers are the Roanoke, the Tar, the Neuse, Cape Fear, the Catauba, and the Pee Dee, which is also called the Yadkin. The state has a number of natural lakes, such as the Mattamuskeet, the Phelps, and the Waccamaw.

The climate of North Carolina is varied. In the Atlantic Coastal Plain and the Piedmont Plateau, the climate is subtropical, while in the Blue Ridge Region the climate is humid continental. In the higher, mountainous elevations, cold winters are followed by relatively cool summers. North Carolina winters are mild in the Piedmont Plateau and Atlantic Coastal Plains, since mountains protect the area. While rain falls throughout the year, it is more prevalent in the late winter and in summer. Snow is frequent throughout the Blue Ridge Region.

North Carolina's coasts are often subject to hurricanes, but the interior can be struck as well—in 1989 Hurricane Hugo wrecked havoc on the inland city of Charlotte. Tornado season also poses a threat to the state.

Approximately two-fifths of the entire state of North Carolina falls within the Atlantic Coastal Plain made up of coastal lands and tidewater. Soft sedimentary rocks form the foundation of the land in this section. Swamps, marshes, and sounds are also found throughout the area. The best known of the swamps is the Dismal Swamp, which spans parts of both North Carolina and Virginia. Transportation in this area was treacherous until the Dismal Swamp Canal was created, connecting North Carolina's Albemarle Sound with Virginia's Chesapeake Bay. The Dismal Swamp Canal is the oldest man-made canal in continual operation in the United States.

### OUTER BANKS

Albemarle Sound as well as Pimlico Sound are located between the mainland of North Carolina and a group of offshore islands known as the Outer Banks, which include the islands of Cape Hatteras, Cape Lookout, and Cape Fear. The Piedmont Plateau, with its moderately fertile soils and low elevations, comprises an additional two-fifths of North Carolina. This area is

separated from the Atlantic Coastal Plain by the Fall Line where rivers descend, creating rapids and waterfalls as the two geographical areas converge.

### BLUE RIDGE REGION

The remaining fifth of North Carolina makes up part of the Blue Ridge Region of the southeastern United States. The North Carolina section of the APPALACHIAN MOUNTAINS includes both the Blue Ridge Mountains and the Great Smoky Mountains, containing more than 200 mountains with elevations of more than 500 ft (152 m). These mountains tend to be round in shape with steep gorges. The area also has a number of basins such as the one located in Asheville. Roads and tunnels provide access along the Blue Ridge Parkway. The Great Smoky Mountains, part of the southern Appalachian chain, hosts a national park where park officials have identified over 10,000 plants and animals in the area and believe that another 90,000 species have yet to be identified.

Forests of shortleaf, longleaf (the state tree), loblolly, and Virginia pine are prevalent throughout North Carolina's section of the Southeastern Pine Forest. Cypress and various hardwoods are found in wet areas of the state. Oak, hickory, tulip, and poplar are common among the lower slopes of the Blue Ridge Region, while the higher slopes are home to birch, beech, maple, and hemlock. Spruce and balsam are found in the highest regions of the mountains. North Carolina flowers include rhododendron, azalea, camellia, dogwood (the state flower), and orchid. Animals found throughout the state include Virginia deer, opossum, raccoon, squirrel, and fox. Black bear are common in the Coastal Plain forest and in the Blue Ridge Region. The North Carolina coast serves as a home to migrating birds such as ducks, geese, and various waterfowl. The state's numerous songbirds include cardinal (the state bird), blue jay, woodpecker, Carolina wren, mourning dove, purple finch, and towhee.

The economy of North Carolina was heavily dependent on agriculture until the 1920s. At that time, the manufacturing of textiles, furniture, and tobacco products became the mainstays of the economy. Tourism bolsters the North Carolina economy by approximately \$1 billion a year. By the 1990s, agriculture and forestry also assumed significance for the state economy. Major farm products for the state include tobacco, corn, cotton, hay, soybeans, peanuts, wheat, sweet potatoes, and various other vegetables. Industries include metallurgy, chemicals, and paper. North Carolina's most important minerals are quartz, lime-

stone, phosphate rock, sand and gravel, granite, feldspar, talc, lithium, mica, asbestos, and gemstone. North Carolina is the country's leading producer of mica and lithium. The quartz found in the Blue Ridge Mountains is used in microprocessors throughout the world because of its unusual purity.

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## North Dakota

NORTH DAKOTA, THE Flickertail State, is a land of endless fields of corn, sunflowers, wheat, and buffalo. The state has a small population but is rich in natural resources. Located in the north central UNITED STATES, North Dakota was named after the Sioux Indians who called themselves the Dakota. Rural depopulation is a serious problem in much of the state, but North Dakota also has several growing cities, such as its largest city, Fargo; its capital, Bismarck; Grand Forks; Dickinson; and Pembina. Theodore Roosevelt came here in 1883 and became a famous rancher. Today, there remains a national park named after him in the western part of the state.

North Dakota is the 17th-largest state in land area with a total area of 70,704 square mi (183,123 square km). It is 360 mi (579 km) long from its eastern boundary with MINNESOTA and its western boundary with MONTANA. The state extends for 210 mi (338 km) from the Canadian provinces of Saskatchewan and Manitoba in the north to its sister state of SOUTH DAKOTA in the south. The 2003 estimated population was 633,837. About 95 percent of its residents are white and 4 percent are Native American. Most are of German and Norwegian heritage and subsequently most are Lutheran or Roman Catholic.

North Dakota's physical landscape can be divided into three steps going from east to west. The first, which is the most densely populated, is the Red River Valley. It has fertile soil and productive farming. North Dakota's lowest point is in Pembina County at the Red River at 751 ft (229 m). Going west, one hits the higher

Drift Prairie region, made up of dark, fertile soil, rolling hills, lakes and streams, and the Turtle Mountains on the central northern boundary of the state. The Missouri Plateau, which is part of the Great Plains, covers the southwestern part of the state. This sparsely populated area includes the famous Badlands of the Little Missouri River and North Dakota's highest point, White Butte at 3,507 ft (1,069 m).

The state's climate is subhumid continental with short, hot summers and long, very cold winters. Rainfall is sparse to moderate with some drought periods. The precipitation increases as you go farther east. The climate and topography of North Dakota also impact its vegetation. The state is primarily prairie and plains, with only 1 percent of its land area covered by forests.

At the time of European arrival, the native Mandan, Arikara, Hidatsa, Cheyenne, Yankton Sioux, Chippewa, and Dakota tribes were found throughout the state. The area was first explored by the French, was acquired by the United States through the LOUISIANA PURCHASE in 1803, and was later explored by Meriwether Lewis and William Clark. In 1861, North Dakota became a territory with South Dakota, and in 1889, North Dakota became a state. Railroads simultaneously encouraged Norwegian, Swedish, German, and other immigrant farmers to settle the area.

Partially because of its extremely low unemployment rate, North Dakota has a strong economy. It is heavily based on agriculture, and the state is the country's leading producer of barley, oats, flaxseed, and other crops. Other important commodities include wheat, sunflowers, potatoes, corn, and livestock. The state also has generous reserves of oil, gas, and lignite which contribute to the fact that energy production is North Dakota's second most important part of the economy. The service sector contributes the largest part of the state's gross product. Manufacturing, including food processing and machinery, is also important.

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## North Slope

THE NORTH SLOPE of ALASKA stretches from the high mountains of the Brooks Range to the ARCTIC OCEAN on the north. Miles of barren coastal plains and low, rolling hills, caused by freezing and thawing of the ground, make up the region. No trees are in evidence, as the short growing season will support only tundra plants. The word *tundra* comes from the Finnish word *tunturia*, meaning treeless plain. Tundra is characterized by extremely cold climate, limited drainage, a short growing season, and few plants and animals. Soil forms slowly and there is a layer of permanently frozen subsoil called permafrost. There is very little daylight in winter and temperatures are bitterly cold. In Barrow, the northernmost city on the North Slope, the winter temperatures can get down to -50 degrees F (-46 degrees C). Summer temperatures in Barrow average 40 degrees F (4.5 degrees C). Some parts of the North Slope are a bit warmer, but the whole area has a chilly arctic climate.

The North Slope receives only about 5 to 15 in (12.5 to 37.5 cm) of precipitation a year. During warmer weather, water stands on the surface, causing numerous small lakes. Wide shallow rivers flow north to the ocean. Sedges, reindeer mosses, low shrubs and grasses grow on the tundra, as well as 400 varieties of flowers. The plants must adapt to strong winds, low temperatures, and poor soil. Herds of caribou roam the area in summer. Other animals that live on the North Slope at some time of year include wolves, foxes, polar bears, seals, whales, and small mammals such as lemmings, voles, and ground squirrels.

The entire North Slope, which encompasses over 89,000 square mi (230,509 square km), is organized into one borough, making it the largest municipality in the world. The region is about the size of the state of MINNESOTA and lies entirely above the ARCTIC CIRCLE. Many of the people live a subsistence lifestyle and depend on hunting, trapping and whaling for much of their food.

There is no commercial agriculture within the North Slope, because of the short cool growing season and poor soil. Some people have gardens for their own use. The growing season has very long hours of sunlight, but produce has to be limited to plants that will grow and mature in temperatures ranging from 50 to 60 degrees F (10 to 16 degrees C). Besides Barrow, the North Slope includes the villages of Anaktuvuk Pass, Atkasuk, Kaktovik, Nuiqsut, Point Hope, Point Lay, and Wainwright. Most of the people who live here are

Inuit. They used to be known as Eskimos, but prefer the term *Inuit*, which means "the People."

Petroleum was discovered at Prudhoe Bay in 1968. An 800-mi (1,287-km) pipeline was built and began carrying oil south to the port of Valdez in 1977. There is still controversy over whether or not oil drilling should be allowed in the ARCTIC NATIONAL WILDLIFE REFUGE in the far northeast part of the North Slope. The refuge includes 10,039 square mi (76,000 square km) of land. Research shows that lasting environmental damage has resulted from oil drilling at Prudhoe Bay.

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## Northern Mariana Islands

A COMMONWEALTH IN political union with the UNITED STATES, the Northern Mariana Islands (or CNMI) consists of a string of fourteen volcanic and limestone islands in the far western PACIFIC OCEAN. The islands have closer ties to American and European culture than most others in the region and have therefore opted to retain political and economic integration with the United States rather than seek the free association status of its neighbors.

The Marianas form a segment of a chain of volcanic islands that stretch north from eastern INDONESIA to JAPAN, following alongside a deep ocean trench (the Mariana Trench, which includes the deepest points on the planet) along the edges of the Philippine and Pacific tectonic plates. The three larger islands at the southern end of the chain (Saipan, Tinian and Rota) have 99 percent of the population (86 percent on Saipan), and most of the economic activity. They are volcanic in origin but older than the more recently formed islands to the north and have had longer to form fertile soil through erosion. The small northern islands are thus much taller and steeper (Agrihan is the highest point in all of MICRONESIA) and continue to see volcanic activity: Farallón de Pájaros, Asuncion, Pagan, and Guguan

have all erupted in the 20th century, Pagan most recently in 1981, forcing the evacuation of its small population, and Agrihan continually erupting since May 2003. These northern islands have little soil and insufficient rain so have little population.

The island of GUAM is the southernmost island of the Mariana chain but has been administered separately since it passed from Spanish rule to U.S. jurisdiction in 1898. The Northern Marianas were also governed by the Spanish, starting in the mid-16th century, but were sold to GERMANY in 1898, and annexed by Japan in 1914, before finally joining Guam under U.S. administration as part of the United Nations Trust Territory of the Pacific in 1947. The main island, Saipan, served as headquarters for the entire Trust Territory from 1962, while the neighboring island of Tinian was an important Central Intelligence Agency training base for Nationalist Chinese troops. The third major island is Rota. A covenant establishing the islands as a commonwealth with full internal autonomy plus U.S. citizenship was developed in the 1970s and went into effect in 1986.

The local economy benefits significantly from U.S. financial assistance, but is beginning to establish itself independently through tourism, mostly from JAPAN—Saipan is 5,625 mi (9,073 km) from San Francisco, CALIFORNIA, but only 1,272 mi (2,052 km) from TOKYO, Japan.

The tourist industry now employs 50 percent of the workforce and accounts for about half of the total gross domestic product. This, and the emerging garment industry has attracted heavy immigration from CHINA and the PHILIPPINES. Total population figures have risen from just under 17,000 in 1980 to over 80,000 today. Non-U.S. citizens make up about half the population, with Filipinos alone forming roughly a third of the population, but figures are shaky because of illegal migration, and the local native Chamorro people are increasingly dissatisfied with being a minority in their own territory.

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## Norway

**Map Page** 1130 **Area** 125,182 square mi (324,220 square km) **Population** 4,546,123 **Capital** Oslo **Highest Point** 8,148 ft (2,469 m) **Lowest Point** 0 m **GDP per capita** \$31,800 **Primary Natural Resources** petroleum, copper, natural gas, pyrites, nickel.



NORWAY IS A LONG, narrow country, stretching from the North Sea to the ARCTIC OCEAN, roughly the same length as the eastern coast of the UNITED STATES. Most of its terrain is rocky and mountainous, leaving little room for settlement or agriculture. Norwegians have thus traditionally turned to the sea for their livelihood; and although fishing remains a crucial industry, along with shipping—Norway's fleet is the fourth largest in the world—since the 1970s, it has been oil and natural gas pumped from the sea that has transformed the economy into one of the most dynamic in all of Europe. And because Norway generates nearly all of its electricity from hydroelectric stations on its swift mountain rivers, most of its oil is exported, making Norway the second largest oil exporter and providing a generous trade surplus that has been translated into one of the most comprehensive social welfare systems and the highest standard of living in the world.

Measuring Norway's coast can yield varying results: the direct distance from point to point is about 1,100 mi (1,770 km), while measurements that include all of the thousands of fjords and inlets bring the number closer to 15,592 mi (25,148 km). Including the 50,000 or so islands off Norway's coast, the distance rises again to 36,042 mi (58,133 km), giving Norway the longest coastline in the world. Norway occupies the western part of the Scandinavian Peninsula, shared with SWEDEN. The mountainous backbone of the peninsula, the Kjølén, forms the 972-mi (1,619-km) border with Sweden, except in the south, where Norway's territory includes the relatively flat basin east of the mountains, the location of the city of Oslo and the country's principal river, the Glåma.

Norway also shares a border in the far north with FINLAND, and a small stretch of border with RUSSIA (122 mi or 196 km), along the coast of the Barents Sea. The kingdom also includes several dependencies: BOUVET ISLAND in the South Atlantic, Peter I Island in the South Pacific (both close to ANTARCTICA), Jan Mayen in the



North Atlantic, and Svalbard, an archipelago north of the mainland, bordering on the Arctic Ocean.

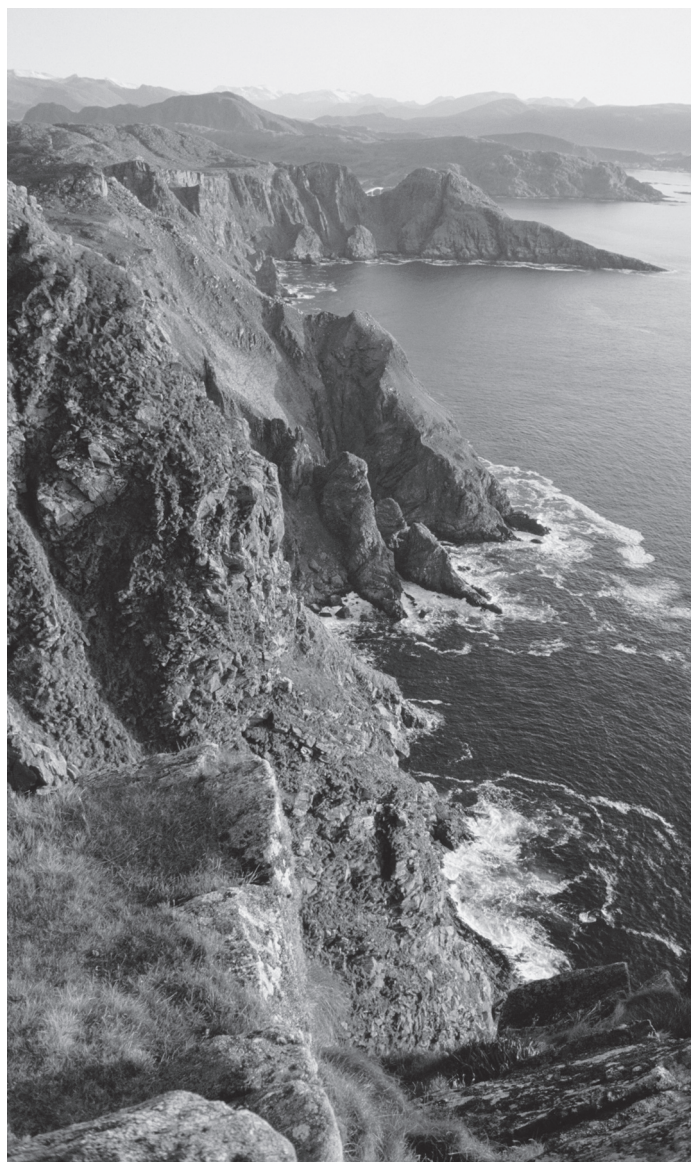
Norway's geologic features are very old, dominated by the ancient Fennoscandian (or Baltic) Shield, and the mountainous chain that rises above it—a range that matches in age and structure the highlands of northwest Scotland and the Appalachian mountains in the eastern United States. The rocky surfaces of these land masses are worn down and marked by several waves of glaciation; most of Norway's coastal regions are bare or thinly covered rock.

Glaciation is also responsible for Norway's most characteristic feature, its long, narrow fjords, bordered by rugged peaks. Nearly 2,000 glaciers are left over from the last period of ice cover. The climate is cold, but moderated by warmer air from the Gulf Stream. In the far north, arctic conditions are more common. This area is home to Norway's Lapp, or Sami, population, many of whom continue to lead a traditional lifestyle of reindeer herding, though today this is largely done by snowmobile rather than on foot. In these areas, land of the midnight sun, the sun never drops below the horizon from May to July.

Norway has been fully independent only since 1905. Several centuries before, a Viking maritime empire had dominated the North Sea and North Atlantic, with settlements in ICELAND, GREENLAND, parts of Scotland and IRELAND, and even as far south as northwest FRANCE, an area of which they gave their name, Normandy. From the late 14th century, however, Norway lost its independence to Denmark and remained a satellite kingdom for four centuries before being transferred to the jurisdiction of Sweden during the 19th century. Norway was one of the first nations to join the NORTH ATLANTIC TREATY ORGANIZATION (NATO) after World War II but was less willing to join the common market, rejecting EUROPEAN UNION (EU) membership in referenda in 1972 and 1994. Besides the petroleum and gas industries, Norway's economy is dominated by food processing, shipbuilding, pulp and paper products, machinery, chemicals, and the centuries-old mainstay, fishing.

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*Rugged and mountainous, Norway's coastline has been measured as the longest in the world.*

## Nubia

NUBIA, KNOWN AS THE Gateway to the SUDAN, does not exist as a political entity in the 21st century. Geographically, the section of Northeast Africa that was once Nubia has been encompassed into northern Sudan and southern EGYPT, with cataracts (areas where geological forces have formed outcroppings of rock) along the NILE RIVER determining Nubia's so-called boundaries. The land once known as Nubia is located

between the First Cataract south of Aswan and the Sixth Cataract near KHARTOUM. Contemporary Nubia ranges from the Nubian Desert, which makes up the easternmost section of the Sahara Desert, to the more fertile Nile Valley area.

Since 1970, as a result of the High Dam Project initiated by Egyptian president Gamal Abdul Nasser, most of Nubia has been covered by Lake Nasser, the world's largest lake. Some 120,000 Nubians were relocated to cities such as Kom Ombo, Sukkot, Mahas, and Halfawi in Egypt and New Halfa and Khashm al-Girba in the Sudan. Some Nubians refused to leave the area, preferring to move to higher grounds away from the dam. In new communities, approximately 85 percent of all Nubian males were forced to find work outside the areas. Some Nubians continue to be employed in traditional service jobs. However, as Nubians have become more educated, large numbers have become doctors, lawyers, teachers, and other professionals. Recently, after years of exile, a number of Nubians returned to the banks of the Nile River through the efforts of the High Dam Lake Development Authority with government grants to establish new agricultural communities.

### NUBIAN HISTORY

Nubian history is portioned into three major periods: ancient, Christian, and Islamic. Ancient Nubian culture dates from 34th century B.C.E. to the 4th century C.E. Nubia began as a pastoralist area until urban centers emerged around the 26th century B.C.E. These cultures are referred to as A-Group and C-Group respectively. A major trading center, Kerma, flourished in Upper Nubia around 2500 to 1550 B.C.E. Kerma's unique burial mounds and delicate objects suggest a highly advanced civilization, and it is known from Egyptian records that Kermans traded extensively with Egypt and other states in the eastern Mediterranean.

When Egypt lost power in the region during a period of fragmentation about 1700 B.C.E., the Kerman kings also gained control of parts of Lower Nubia, absorbing C-Group cultures. The Egyptians retook most of Nubia, including Kerma, after the latter's resurgence between 1550 and 1450 B.C.E. Lower and Upper Nubia were separated into the Egyptian provinces of Wawat and Kush. During that time, most of the region's politics absorbed Egyptian culture and customs, though they retained a separate identity.

Kush eventually overtook Egypt to form the 25th "Cushite" Dynasty that ruled Egypt and Nubia between 750 and 663 B.C.E. Subsequent Nubian capitals

at Napata and Meröe consecutively lasted until the 3rd century C.E., when Meröe was destroyed by the Ethiopians.

The X-Group or Ballana culture marks Nubia's transition to the Christian era. Ballana replaced Meröe as the predominant culture in the region, and was absorbed into the Kingdom of Noabdia, which became fully Christianized under Byzantium influence during the 5th and 6th centuries. Two successive states, Makuria (which absorbed Nobadia) and Alodia emerged in the 7th century. Nubia became an isolated region, cut off from the Byzantine world during Muslim expansion; despite this, the region managed to retain its Christian identity until the 15th century, when it dissolved through conquest and intermarriage. As the Ottomans occupied Nubia proper, the Funj Empire was created in southern Nubia. Both areas were conquered by the Egyptians, then the British, during the 19th century. Nubia became a joint Egyptian and British protectorate in 1899, and was renamed the Anglo-Egyptian Sudan.

### NUBIAN GEOGRAPHY

Geographically, Nubian land is made up of arid desert filled with sand and black rocks. The desert climate results in hot, dry summers and moderate winters. The Egyptian section of Nubia rarely sees rain, and the Sudanese section sees only small amounts. Khartoum, for instance, rarely sees more than 7 in (18 cm) annually. In addition to persistent draught, Nubians must also contend with dust storms, earthquakes, flash floods, and landslides that can damage crops and threaten lives and property.

The rock throughout Nubia is either sandstone or granite. In sandstone areas, the Nile Valley is made up of wide alluvial floodplains. This area near Aswan is the most fertile section of Nubia. Nubian land is bordered on the east and west of the Nile by cultivated fields. The western section is dotted with a number of small watering holes. In Upper and Southern Nubia, sections of granite formation have resulted in narrow, sharp cliffs that are generally infertile. This section has been divided into the Batn el Hajar, the Abri-Delgo Reach, the Dongola Reach, the Abu Hamed Reach, and the Shendi Reach, making up five distinct topographic regions along the Nile River.

Nubia was considered a major location along the African trade route and provided essential natural resources such as gold, ivory, copper, ebony, and dolerite. Since ancient times, the palm tree has also provided a major component of the Nubian economy. Palm trees

are frequently given as gifts. They are also used to manufacture a number of products such as furniture and rugs and are used as fuel and animal food. The fruit of the date palm continues to be the most economically viable byproduct of Nubian palms. Other agricultural products of modern Nubia include sorghum and millet.

Transplanted Nubians maintain many of their traditions and cultural characteristics. In addition to Arabic, Nubians have continued to speak dialects such as Sukot, Halfawi, Mahas, and Dongolawi. Understanding the importance of customs and rituals to a displaced people, Nubians form their own closely knit communities in areas of migration. Ancient Nubian rituals are often centered on the all-important Nile River. Newborn infants were immersed in its waters for protection. Newlyweds bathed in the Nile to promote fertility. As part of the mourning ceremony, Nubian women washed mud and blue dye from their bodies. Henna and perfumes were submitted as offerings to the great Nile River. The belief in water angels survived the introduction of both Christianity and Islam into Nubia.

The New Nubia Museum, which opened in November 1997, was erected near the Cataract Hotel in Aswan to bring together over 2,000 Nubian treasures and relics, including jewelry, pottery, and scarabs. The centerpiece of the museum is a gigantic statue of Rameses II. Overall, 23 Nubian temples and shrines were relocated, including the temple of Queen Hatshepsut, which was dismantled and transported in crates to Egypt's National Museum. The temple of Kalabsha,

the memorial chapel of Rameses II, and the Kiosk of Kertassi have been reconstructed near the High Dam. While most of the archaeological finds remain in the area, Nubia has become familiar to people in other areas through the relocation of significant relics to museums around the world in response to donations to UNESCO's (United Nations) massive preservation project of the 1960s. Such relics include the Temple of Dendur, which has been relocated to the Metropolitan Museum in New York City, and the Greco-Roman temple of Debod, now located in Madrid.

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## Ob-Irtysh River

THE OB AND THE IRTYSH rivers together form one of the largest river BASINS in the world, but also drain an area among the least populated and least known to outsiders. The rivers flow from the isolated mountain ranges of Central Asia (the ALTAI and Sayan ranges) across the sparsely populated Western Siberian Lowland to the Kara Sea, a subsidiary of the ARCTIC OCEAN. Population density for the basin as a whole is only nine persons per square km, but there are several large cities clustered around the mineral wealth of the river's southern watershed: Omsk on the Irtysh and Novosibirsk on the Ob are the largest cities in SIBERIA, along with Chelyabinsk, located on a tributary in the western part of the Ob-Irtysh Basin, in the URAL MOUNTAINS, which form the basin's western boundary. The basin covers 1,159,274 square mi (2,972,497 square km)—roughly the same as the MISSISSIPPI basin—and lies mostly within RUSSIA, though the southernmost courses of the Irtysh flow through northern KAZAKHSTAN and small corners of MONGOLIA and XINJIANG, CHINA. Altogether the rivers and their tributaries connect about 17,000 miles (27,400 km) of navigable waterways, though most of these are frozen for much of the year.

The Ob and Irtysh Rivers both have their headwaters in the highlands of the Altai Mountains, on the borders of Mongolia, where peaks reach heights of

13,200 ft (4,000 m) or more. This is one of the most remote spots on Earth, where four countries come together (Russia, Kazakhstan, Mongolia, and China), over 3,000 mi (4,800 km) from the sea. The two rivers start on different sides of this range, however, and do not meet up until both rivers have crossed most of the flat Siberian plains. The Irtysh is longer, but the Ob has more volume, and when they meet, at Khanty Mansiysk (a town named for the two dominant local indigenous groups), their course becomes sluggish and marshy. The far north of Russia is mostly flat and marshy, with little precipitation. Agriculture is severely limited by harsh climate and year-round permafrost. The Ob becomes divided into many ribbons, subject to enormous spring floods and dangerous ice flows during summer thaws. Here the river valley can at times reach 25 mi (40 km) wide. The Ob enters the sea through the 600 mi (375 km) Gulf of Ob, a forked indentation of the Kara Sea.

The region was sparsely populated by nomadic peoples (Mansy, Khanty, Nenets, and Samoyedic peoples) for centuries until Russians became attracted to the area for its “soft gold”: furs of numerous squirrels, otters, ermine, mink, and sable. Fortified wooden stockades were built at river junctions as trappers and merchants moved eastward, including such cities as Tobolsk (1587) on the Irtysh, and Salekhard (1595) on the Ob. This latter city is one of the furthest north in all

of Russia, located close to where the Urals meet the Arctic at the Gulf of Ob and where the forests meet the Arctic tundra. Later cities were founded on the upper Ob (Naryn and Tomsk) before the push for furs moved on eastward into Siberia. The large industrial cities of the south were built later, with the development of coal and iron ore industries, especially in the Kuznetsk Basin, and more recent pumping of oil near Surgut on the middle Ob. Because of the river's swampiness and lengthy periods of ice cover (generally October to May), it is not used much for navigation. There has been some harnessing of the great volumes of water flowing off of the Altai Mountains, notably at a hydropower station on the Irtysh in northeastern Kazakhstan, at Ust-Kamenogorsk, close to where the river (called the Ertix) flows out of Mongolia and into the large Zaysan lake. This region is one of Kazakhstan's most industrialized and holds a large portion of its population. The lower parts of the rivers are spawning grounds for sturgeon, salmon and whitefish, and the Ob estuary forms one of the largest fishing industries in the Russian Arctic.

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## Ohio

OHIO IS A MIDWESTERN state in the Great Lakes region of the UNITED STATES. Interestingly, when the first settlers were arriving, the area was considered to be America's great northwest. In the northeast, Ohio is bordered by PENNSYLVANIA from Lake ERIE southward to the Ohio River near East Liverpool. The Ohio River forms a natural boundary between the states of WEST VIRGINIA (southeast) and KENTUCKY (south), while INDIANA provides a western border, and MICHIGAN and Lake Erie provide borders in the north. With an area of 106,765 square km (41,222 square mi), Ohio ranks 34th in size in the United States. With 11,353,140 residents, the state ranks 7th nationally in terms of total population and 9th in terms of population density.

Cleveland is the center of the state's largest metropolitan statistical area (MSA), although Columbus is the largest city and the state capital. Other major cities are Cincinnati, Dayton, Toledo, and Akron. Overall, the ten largest cities in Ohio, six with populations greater than 100,000, account for 22 percent of the state's total population. Ohio was the 17th state to join the United States (March 1803).

From the dunes along the shores of Lake Erie to the gorge cut by the Ohio River in the south, the land is generally flat over the eastern half of the state, with rolling hills in the east and small rugged hills in the southeast. Before the first settlers came to the region, much of the land was covered with miles of virgin forest, including numerous Buckeye trees from which the state derives its nickname. Today, only vestiges of the dense woodlands that helped to build the many cities remain.

Ohio's topography consists of three easily identifiable regions with a general northeast to southwest trend: the Great Lakes Plains, the Central Plains, and the Allegheny Plateau. There are also two smaller notable physiographic zones. One is a small strip in the north bordering the Lake Erie shoreline called the Lake Erie Plains. This region, which varies in width from 50 mi (81 km) at Toledo's Maumee Bay to 10 mi (16 km) at Conneaut near the Pennsylvania border, extends for all 312 mi (503 km) of the Ohio portion of the Lake Erie shoreline. The shoreline itself also has two very different geographies.

Along the eastern half of the shoreline in the northern extreme of the Allegheny Plateau are clay bluffs often 8 to 10 ft (2 to 3 m) high, while the western half of the shoreline in the Central and Great Lakes Plains has beaches of clay and sand. The other is a narrow region extending southeastward along the Miami River from Indian Lake in the east central part of the state to the Ohio River in the very southeastern corner.

The state's highest point (1,549 ft or 472 m)—just southeast of Bellefontaine in the east central part of the state—and the lowest point (455 ft or 139 m), on the Ohio River at the Indiana and Kentucky borders, also lie within this region.

Other important rivers with impact on both the physical and economic geography include the Scioto, which runs from north of Indian Lake south through the middle of the state to the Ohio River at Portsmouth; the Muskingum, which drains a large portion of the southeastern Allegheny Plateau entering the Ohio at Marietta; and the Maumee, which runs northeasterly across the northeastern part of the state to

Maumee Bay at the eastern end of Lake Erie and Toledo.

In prehistoric times Ohio was home to mound builders, many of whose mounds are preserved in state parks. Prior to the arrival of Europeans, the Native Americans living in the area included the Iroquois, Erie, Miami, Shawnee, and the Ottawa. The French were the first Europeans to claim the area when La Salle was exploring the Ohio Valley in 1669. The region was soon a haven for fur traders and land grabbers. By the 1750s, the last of the French and Indian Wars saw the French losing and control of the area given to the British. In 1763, the British issued a proclamation forbidding settlement west of the Appalachian Mountains, furthering unrest in the region, and in 1774 issued the Quebec Act, putting the region within the boundaries of CANADA. In 1783, the Treaty of Paris ceded the area to the United States, and by 1787, the area became the first region in the Old Northwest to be organized under the Ordinance of 1787. In 1788, Marietta became the first permanent American settlement founded on the Old Northwest. In 1802, a state convention drafted a constitution, and in 1803 Ohio entered the Union, with Chillicothe as its capital. Columbus became the capital in 1816.

Following the War of 1812, Ohio's growth was spurred by the building of the Erie and other canals, and toll roads. The National Road was a vital settlement and commercial link. After the Civil War, increased shipments of ore from the upper Great Lakes and the development of the petroleum industry in northeastern Ohio helped shift the center of economic activity from its fur-trading origins along the banks of the Ohio River to the shores of Lake Erie. Ohio was hit hard by the Great Depression but rebounded during and shortly after World War II. The state economy was particularly depressed during the 1970s and 1980s as the automobile, steel, and coal industries virtually collapsed, with many of the northern industrial centers losing significant portions of their populations. Since the late 1980s, the state has sought to diversify its economy through enlargement of the service sector.

Although highly industrialized, the availability of mineral resources has kept the state among the national leaders in the production of lime, clays, and salt. The state is also a historic center of the nation's ceramic and glass industries. Ohio has extensive farmlands in those areas enriched by limestone during the last ice age, producing large amounts of corn, soybeans, hay, wheat, cattle, hogs, and dairy items. Although agricultural production remains important to

the state, the number of family farms is rapidly declining.

Railroads, canals, and highways continue to provide significant transportation linkages for raw materials and manufactures. The state's ports on Lake Erie, especially Toledo and Cleveland, handle iron and copper ore, coal, and oil in addition to finished goods such as steel and automobiles parts. In spite of the general industrial decline since the late 1960s, the state has retained many important manufacturing centers for transportation equipment, primary and fabricated metals, and machinery. Nationally, Ohio ranks 7th in terms of total gross state product (\$374 million) and 20th in per capita income (\$27,977).

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## Okavango

COVERING AN AREA roughly the size of CONNECTICUT, Okavango is the largest inland DELTA in the world. It is located in north-central BOTSWANA in the middle of the KALAHARI DESERT and is formed by the Cubango and Cuito rivers flowing out of mountains in ANGOLA and into the Okavango River.

Okavango covers a swampy depression that was once a prehistoric lake. The northern part of the swamp is always wet with lots of papyrus growing in it and covers about 2,320 square mi (6,000 square km) of the Okavango area. A small shelf of sediment about 16 ft (5 m) high from the Kalahari confines the delta here. The southern part of Okavango fills seasonally during the rains and covers another 2,700 square mi (7,000 sq km) and up to 4,630 square mi (12,000 sq km) depending on how much rainfall they get each year. In this area the delta branches out into three main channels: the Thaoge to the west, the Jao/Boro in the center, and the Nqoga/Maunachira to the east. Average water depth in the swamps of Okavango are about 5 ft

(1.6 m). Much of this area is also covered in vegetation that grows profusely due to the rich silt constantly being brought in by the Cubango and Cuito Rivers. These rivers bring a flood of water during the rainy season peaking in March or April. The water is really a blessing to this area since otherwise the delta would only get about 19 in (50 cm) of rain per year. It would have turned into part of the Kalahari Desert long ago were it not for the water flowing into the area. Only 2 percent of water in Okavango actually flows out of the delta area via the Boteti River. This is due to the huge amount of evaporation that occurs in this area. More than 72 in (180 cm) of water evaporate each year because of the average daily temperatures of 86.7 degrees F (30.4 degrees C) in Okavango. The papyrus is well adapted to this type of climate and is one of the fastest growing plants on Earth. It has spread throughout Okavango, sending seeds downstream to become new plants. Papyrus forms beds, which become their own islands in the swamps of Okavango, towering overhead like a jungle.

The upper region of Okavango that is permanent swamp is often called the Panhandle portion of the delta. The region below this is a broad and slightly fan-like area with a gentle slope to it. At the edge of this fan area, there are two major depressions: the Mababe Depression in the east and Lake Ngami, which is currently dry, in the west. In response to the amount of silt in the area, the dense vegetation, shifting of the Earth's crust, and the constantly moving water, over time Okavango's delta has changed shape. Both of these areas contained actual lakes in the past and are now wide grassy areas with rich soil where the Damara people of the region herd sheep and cattle.

Okavango is an extension of the East African Rift System of faults. Two parallel fault lines in the Panhandle confine the upper portion of the delta where the Okavango River enters the Kalahari Basin. The Thamalakane and Kunyere faults define the southeast limit of the delta. At 125 mi (200 km) long, the Thamalakane fault acts like a natural dam from which the Boteti River flows out of the delta. The parallel Gomare fault, a continuation of the Great Rift Valley of eastern Africa, runs southwest to northeast at the southern end of the Panhandle.

After passing through this fault, the swamps then branch out in the alluvial fan formation of the rest of Okavango's delta. The rift between the Gomare and Thamalakane faults is what is believed to have originally formed the geographical basis for the Okavango delta of today.

This whole area supports a wide variety of wildlife. In the swampy Panhandle area live hippopotamuses, crocodiles, and predatory fish along with other smaller species of fish, numerous invertebrates, and thousands of insects. The crocodiles of this area can grow to extraordinary size because they have a tendency to feed on larger mammals that graze along the delta's floodplains. In the Panhandle are many areas of exposed sandbanks that serve as a breeding ground for the Okavango's crocodiles and several African birds including the graceful skimmers and the magnificent Pel's fishing owl.

During the dry time in the delta, huge herds of large mammals migrate in to take advantage of the plentiful grasses. Elephants, buffalo, zebra, wildebeest, impala, bushbuck, warthog, eland, impala, gnu, springbok, and various other antelope come here by the hundreds and thousands, followed by their natural predators, such as lions, leopards, and the nomadic tribal hunters of the area. There are birds of almost every species here, including geese, ducks, teal, bitterns, egrets, ibises, flamingos, and hundreds of other waterfowl. It is said that the game viewing here is better than in the Serengeti of Kenya and Tanzania.

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## Oklahoma

**LOCATED MIDWAY BETWEEN** the east and west coasts of the UNITED STATES and just south of the geographic center of the United States in KANSAS, Oklahoma is one of the Great Plains states. The name comes from the Native American Choctaw language as *okla* meaning "people," and *humma* meaning "red." Despite images to the contrary, Oklahoma has a unique geography that serves as a transition zone between the forested mountain woodlands of the east and the deserts and mountains of the west. The land rises gently from 207 ft (87 m) above sea level in the extreme southeast to 4,973 ft (1,516 m) above sea level at Black



Mesa in the northwestern corner in an area known as the Panhandle.

Oklahoma offers a variety of features, from grassland plains in the west to forests and mountains in the east. Most of the state is a great, rolling plain, sloping gently from northwest to southeast. Although the region is considered part of the Great Plains, Oklahoma has four mountain ranges: the Ouachita in the southeast, the Boston in the northeast (part of the Ozark Plateau that runs across northwestern ARKANSAS and MISSOURI), the Arbuckle in the south-central part of the state just north of the TEXAS border, and the isolated Wichita in the southwest. Approximately 24 percent of the state's total area is forested, generally in the mountainous regions along the Missouri and Arkansas border. Throughout the northwest and the Panhandle are sudden outcrops of sandstone and gypsum, sharp ravines, and stark hills. The Panhandle may be one of Oklahoma's most recognized map features; that strip of land in the northwest that extends west from the main body of the state as if it were pointing at something. In the north-central region there are several salt flats near the border with Kansas. The largest of these, the Great Salt Plains, covers about 25 square miles (65 square kilometers) near the city of Cherokee.

Oklahoma is bordered by COLORADO and Kansas in the north, by Texas in the south, by Missouri and Arkansas in the east, and by NEW MEXICO and Texas in the west. With a total area of 69,956 square miles (181,186 sq km) the state ranks 18th nationally in terms of size, including 1,137 square miles of water. Oklahoma's estimated resident population at the end of 2003 was 3,511,532, ranking 27th nationally. Because 41 percent of the state's population lives in the 10 largest cities, the state feels incredibly open and free. Oklahoma City, with a population of 523,303, is the state's largest city and capital, while Tulsa, with 387,807 people, is the state's other major metropolitan area.

The state has a number of important rivers, but the four major rivers are the Arkansas, Red, Canadian, and Grand (or Neosho). The Red River also forms the state's southern boundary with Texas. The other significant rivers and streams, all flowing into either the Arkansas or the Red, are the Illinois, Verdigris, Poteau, Canadian, Cimarron, Salt Fork of the Arkansas, and the Washita. Several of the larger rivers in the eastern half of the state have been dammed creating a number of large lakes. Largest of the more than 60 such reservoirs are Eufaula, Texoma, the Grand Lake of the Cherokees, and Robert Kerr.

Most of Oklahoma has a warm, dry climate. The northwestern part of the state is cooler and drier than the southeast. Precipitation varies greatly throughout the state. Annual average precipitation ranges from 50 in (128 cm) in the southeast to 15 in (38 cm) in the western Panhandle. Snowfall ranges from 2 in (5 cm) a year in the southeast to 25 in (63 cm) in the northwest; the Panhandle receives the most snow.

## ECONOMY

Oil made Oklahoma a rich state, but natural-gas production has now surpassed it. Oil refining, meatpacking, food processing, and machinery manufacturing (especially construction and oil equipment) are important industries. Other major commodities include non-electric machinery, petroleum and coal products, food products, fabricated metal products, glass, rubber and plastic products, and transportation equipment. The state's principal minerals are petroleum and natural gas, followed by helium, gypsum, zinc, cement, coal, copper, and silver. Oklahoma's rich plains produce bumper yields of wheat, as well as large crops of sorghum, hay, cotton, and peanuts. Chief agricultural products are beef cattle, sheep, hogs, poultry, milk, wheat, hay, sorghum and other grains, peanuts, pecans, and cotton.

## HISTORY

Native American tribes inhabited Oklahoma when Spanish explorer Francisco Coronado ventured through the area in 1541. The land was included as part of the 1803 LOUISIANA PURCHASE. From the early 1820s until about 1846, the U.S. government waged a continuing effort to move Native Americans from the eastern United States to the Indian Territory (Oklahoma). The Five Civilized Tribes (southeastern United States) were among those tribes forcibly relocated over numerous routes during this time, the most famous being the Cherokee "Trail of Tears."

Immediately after the Civil War, the long cattle drives from Texas to the Kansas railroad centers began, ushering in the age of the cowboy. The cattle were fattened on the rich prairie grasses of Oklahoma as they slowly made their way north to towns such as Dodge City or Abilene. With time, Western folklore became rich with names such as the Chisholm and Cimarron trails. Western expansion of the United States reached the territory in the late 1800s, sparking a major controversy over the fate of the land. The government decided to open the western parts of the territory to settlers by holding a total of six land runs between

1889 and 1895. Included in this land grab was the famous Cherokee Strip or Cherokee Outlet, a narrow piece of land in northern Oklahoma along the Kansas border. Settlers came from across the nation and even other countries to stake their claims. In part because of the discovery of oil, which made Oklahoma the “place to go to strike it rich,” statehood had become a sure thing at the turn of the 20th century, and on November 16, 1907 Oklahoma became the 46th state of the United States.

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## Olduvai Gorge

OLDUVAI GORGE IS LOCATED in the East African Rift Valley of northeastern TANZANIA, on the eastern edge of the Serengeti Plain. Discoveries of fossils dating back 1.8 million years were made there by Louis and Mary Leakey, and Donald Johansen.

The gorge is now part of the Ngorongoro Conservation Area and lies just to the west of two lakes: Natron in the northeast and Eyasi in the south. Its original name was Oldupai, a Maasai word for the sisal plants that grew there.

The Olduvai Gorge extends for 31 mi (50 km), and its steep sides are up to 295 ft (90 m) high. It forms a Y shape, with a branch called the Side Gorge joining with the Main Gorge. Millions of years ago, volcanic eruptions set down the rocks and layered ash that would become Olduvai Gorge.

By 2 million years ago, the area was a shallow alkaline lake, an attractive, swampy habitat for many animal and plant species. About 1.5 million years ago, the area's climate changed drastically. The lake size

lessened, and the fossil records show that species more adapted to a dry savanna moved into the area. Within the last 500,000 years, tectonic activity had created the Olbalbal Depression to the west of the lake, and at some point waters from the lake began to flow into the depression. The Olduvai Gorge was formed by the draining waters, which over millennia carved through the deposits of ash and fossils. Erosion exposed layers of the gorge that date to the lower Pleistocene Age, and have yielded archaeological finds up to 1.8 million years old.

Today, archaeologists divide the stratification into six areas, or beds, with Bed One being the oldest, closest to the basalt bedrock. Although fossils were first found in the area in 1911, nearly 50 years passed before its importance was realized. In 1959, Mary Leakey discovered the skull of a hominid over 1.8 million years old. Originally named *Zinjanthropus* by the Leakeys, it is today called *Australopithecus Boisei*. In the 1960s, the Leakeys also found the first remains of *Homo habilis*, a 1.8-million-year-old hominid, possibly the first hominid to use the tools found at Olduvai Gorge. Both of these were found in Bed One, along with pebble tools.

In Bed Two, which dates to 500,000 years ago, the remains of *Homo erectus* have been found, along with hand axes. Remains of *Homo sapiens* (modern man) have been found in Bed Four.

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## Oman

**Map Page** 1122 **Area** 82,031 square mi (212,460 square km) **Population** 2,807,125 **Capital** Muscat **Highest Point** 9,776 ft (2,890 m) **Lowest Point** 0 m **GDP per capita** \$8,300 **Primary Natural Resources** petroleum, copper, asbestos, natural gas.



OMAN IS LOCATED in the MIDDLE EAST, bordering the ARABIAN SEA, Gulf of Oman, and PERSIAN GULF, between YEMEN and the UNITED ARAB EMIRATES (UAE). It is a country in the lands associated with earliest civilizations.

By 2000 B.C.E., Oman was known for its production of copper in the north, while the south produced frankincense, which was essential to the social religious life of ancient peoples. Oman adopted ISLAM in the 7th century C.E., during the lifetime of the Prophet Muhammad. The Omanis consolidated their power along the coast of the Arabian Sea, flourishing in maritime trade, but this expansion was checked by a Portuguese invasion in 1506. A century of occupation followed, and afterward, once again the Sultan of Oman spread the faith and Arab culture as he extended his conquests to Mombasa and Zanzibar, other portions of the southern Arabian Peninsula, and the Makran coast (now PAKISTAN). At this height of power in 1856, sons of the sultan fought over succession and the empire was split into Zanzibar and Oman. Decline came swiftly, and soon the sultan lacked the funds to placate the Imams of the interior.

By 1913, there was open rebellion. Oman slipped into medieval repression until Sultan Qaboos overthrew his father in 1970. He launched aggressive reform and modernization. The new sultan was confronted with insurgency in a country plagued by endemic disease, illiteracy, and poverty. He judiciously used foreign military support and progressive measures to defeat the separatist revolt and reintegrated the effected provinces.

With Sultan Qaboos's modern and progressive leadership, considerable change has come to ancient and traditional Oman in the past three decades. Many of his economic, educational, and health care improvements have been the first of their kind. The oil industry is modest in comparison to gulf neighbors but has supplied the revenues for national infrastructure improvement and diversification of the economy.

The government has invested in copper mining and refining, as well as the development of light industry. Adoption of modern techniques and equipment in agriculture and the fishing industry is increasing yields and profitability. There is a concerted effort to decrease the dependency on expatriate labor in the public and private sectors. With improved education and training now available, the "Omanization" of the managerial labor force is progressing. The sultan has opened Oman to tourism (another first) and is making efforts to liberalize foreign investment and joint ventures.



*Mutrah Fort in Oman is nestled within the mountains and desert of the Middle Eastern country.*

Most Omanis are Ibadi Muslims, belonging to one of Islam's earliest fundamentalist movements. The Ibadi are distinguished by their conservative doctrine and their system of selecting religious leaders by consensus. This makes Oman unique in the gulf and continues to influence the role of the Sultan to the interior communities and their religious leaders. Oman remains a very conservative society, but one that has a history of contact with the wider world. With its strategic location on the Strait of Hormuz and the mouth of the Persian Gulf, Oman will remain of interest to the industrialized world.

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## Ontario, Lake

LAKE ONTARIO, BORDERED by the UNITED STATES (NEW YORK state) and CANADA (province of Ontario), is the smallest and easternmost of the five Great Lakes, covering an area of 7,320 square mi (18,960 square km). It is 193 mi (311 km) long and 53 mi (85 km) wide, with a shoreline of approximately 480 mi (772 km). It lies 243 ft (74 m) above sea level, the lowest of any of the Great Lakes, while its deepest point is 802 ft (244 m) below the surface. Because its depth serves as a thermal reservoir, Lake Ontario does not freeze in winter except along the shore where the water is shallow. The surface is cool in the summer and warm in winter, and serves to moderate the climate of the surrounding land.

Water comes into Lake Ontario from Lake ERIE by means of the Niagara River and the Welland Canal, which was built to bypass the famous Niagara Falls. Other rivers flowing into Lake Ontario include the Black, Genesee, Oswego, Trent, and Humber. The Genesee and Oswego rivers, combined with the Erie Canal, allow ship traffic to pass from Lake Ontario to the Hudson River, which leads to NEW YORK CITY. Lake Ontario empties into the ATLANTIC OCEAN via the St. Lawrence River.

The lake has long enjoyed an important status for shipping, and the oldest U.S. lighthouse on the Great Lakes was built at Fort Niagara, just beyond the falls, in 1818 to aid in navigation. Lake Ontario boasts many excellent harbors, and their economic importance has only increased since the completion of the St. Lawrence Seaway made it possible to transport goods by water from any of the Great Lakes to the Atlantic Ocean. On the U.S. side of Lake Ontario, Rochester and Oswego are located in New York state. Canada has Coburg, Toronto, Hamilton, and Kingston. Toronto, capital of the province of Ontario, is the largest city on the shores of Lake Ontario.

Beyond these cities, the shoreline is still primarily rural. Although there are excellent orchards all around the lake, the region is not intensively farmed. However,

there is enough runoff from the agricultural regions to exacerbate the pollution load coming from industrial cities upstream. Because Lake Ontario is the last of the Great Lakes, pollutants from all the other four lakes flow through it on their way to the Atlantic Ocean, making it the most polluted of the Great Lakes.

Lake Ontario has seen some commercial fishing, particularly of eels. Large numbers of eels have historically been harvested from Lake Ontario, but eel populations have recently declined to the point that some scientists believe the population may vanish altogether. Ironically, the destruction of eel stocks became a vicious cycle as scarcity drove prices up, making it worthwhile for commercial fishing concerns to go to greater lengths to harvest them.

Excellent state and provincial parks on its shores make Lake Ontario a very popular tourist destination. It boasts excellent sport fishing and hunting, although industrial pollution has made it medically risky for sports fishermen to actually eat their catch. Guidelines generally suggest that an adult should consume wild-caught Lake Ontario fish no more than once a month and that children and pregnant women should not consume any at all.

Geologists believe that Lake Ontario was created as the result of glacial erosion and that it is the remnant of a much larger lake they call Lake Iroquois for the Native American people who lived in the area. The shrinkage of Lake Iroquois into modern Lake Ontario left behind sediments that make for a very rich horticultural region. Lake Ontario was originally named Lake St. Louis in 1632 by the French explorer Samuel de Champlain. This name appeared on maps as late as 1656, but in 1660, Francis Creuxius gave it the name of Ontario, from an Iroquois word meaning "beautiful lake."

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## Oregon

OREGON IS A STATE located on the west coast of the UNITED STATES and has a landscape for just about every-



one: mountains; FORESTS; plains; DESERTS; the Columbia River Gorge; waterfalls such as Multnomah Falls (620 ft or 189 m), the tallest in Oregon and the fourth-tallest in the country; Mills End Park, the smallest park in the world at 24 in (61 cm) across; and Hells Canyon, the deepest gorge in North America.

Oregon, bordered by CALIFORNIA and NEVADA to the south, WASHINGTON to the north, and IDAHO to the east, has an area of 97,073 square mi (251,419 square km). Its population is 3,521,515, the capital is Salem, and the highest point is Mount Hood at 11,239 ft (3,428 m). The lowest point is sea level at 0 m.

Eight regions divide Oregon: the Coast Range, Willamette Valley, Cascade Mountains, Klamath Mountains, Great Basin, Blue Mountains, Columbia Plateau, and Snake River.

The PACIFIC OCEAN and Willamette Valley border the Coast Range. The highest point is Mary's Peak, which is still lower than many Cascade Range passes. The rolling hills force the ocean winds through the narrow strip of land between the range and the ocean. The Coast Range also acts as a wind and moisture barrier to regions east of the range. Many coastal lakes dot the landscape, which consists primarily of sandstone and shale.

Oregon's largest cities, including Portland (529,121 people) and Salem (136,924), are located in the Willamette Valley, east of the Coast Range and west of the Cascade Range. The Willamette River travels north through the valley to the Columbia River, where Portland serves as a major ocean port. Westerly winds moderate the climate, and the year-round precipitation is responsible for the lush forests.

The Cascade Plateau is a mountainous strip east of the Willamette Valley, running from the Columbia River to the California border, and is the recreational jewel of the state, including the Columbia River Gorge, waterfalls, much of the Oregon forest, and volcanic formations, including Mt. Hood and the famous Crater Lake.

The Coast and Cascade mountain ranges border the Klamath Mountains in the southwest corner of the state. The Rogue and Klamath rivers are among many that dissect this primarily conserved area, home to the richest mineral deposits in the state. In addition to the regional lumber and dairy industries, the Oregon National Cave Monument makes this region popular among tourists and the nearby residents. The area is generally moderate in climate, except for the Rogue River valley, which varies from -10 to 110 F (-23 to 43 degrees C).

The Great Basin (30,000 square mi or 48,270 square km) covers most of the southeastern corner of Oregon with the topography continuing into California and Nevada. The Cascade Range to the west cuts off this high desert from eastward winds. Although sparsely populated, some small towns persist, mainly by ranching, but manufacturing and telecommunications, as well as new work on the geothermal potential of the area have kept the towns from diminishing.

North of the Great Basin, the Blue Mountain area is primarily comprised of lava plateaus and several higher mountain ranges, which drain rainwater to the Columbia River. Outdoor recreation, along with some cattle grazing, is the main activity of the region.

Wedge in north and east of the Great Basin, and west of the Cascade Range, the Columbia Plateau is what remains after lava flowed from cracks all over the region, and erosion began forming deep canyons and irregular, mountainous "plateaus." Wheat ranches are a main staple of the area, and several cities and towns sprinkle the region.

Finally, the Snake River region occupies a strip of land along the eastern border of Oregon. The Snake River and Hells Canyon, which descends in some places to a depth of 7,900 ft (2,400 m), dominate the region. Hydroelectric power from the three dams on the Snake River is one of the key economic resources of the area. From border to border, the landscape's diversity finally inspired the travelers on the Oregon Trail to make a home.

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## orogeny

OROGENY, A GEOLOGIC CONCEPT, comes from the Greek *óros*, meaning "mountain," and *genés*, meaning "stemming from." The etymology associates the term with the concept of building mountains, and in the past, orogeny was associated with mountain formation. Its specific use, today however, relates to the

deformation of rocks that leads to postorogenic mountain building. The thrusting, folding, and faulting of crustal plates form structures within fold belts (referred to as mountain ranges). When one plate moves under another, there is uplift, or stacking, which is termed epeirogeny. Epeirogeny is the actual formation of mountains.

The theory of plate tectonics explains the action of volcanoes, earthquakes, continental drift, and ocean-basin widening. The Earth's lithosphere contains the crust and upper portion of its mantle. Twelve or more plates comprise the principal regions of oceanic and continental crust. Plate tectonics involves the formation, lateral movement, interaction, and destruction of the lithospheric plates. These plates become stressed, and in fact break, causing wrinkles and folds. The process of plate movement relieves the Earth's core buildup of internal heat, thus creating many of the Earth's structural formations.

One theory in support of plate tectonics is that convection in the mantle drives sea-floor spreading and continent formation. Orogenous deformation of rocks occurs because of the crust movement. Pressure within the crust results from upper-layer rock weight as this weight compresses the lower layers. Because of crustal movement, rocks at the surface crack and fragment, referred to as joints, whose fracture lines are called faults. Rock displacement creates horizontal and vertical fault lines. Plates overriding or sliding against each other produce the Earth's crustal instability.

New oceanic lithosphere forms through volcanism in the form of fissures at mid-ocean ridges. Heat escapes the interior as this new lithosphere emerges from below, causing plate divergence or ocean-floor spreading. The lithosphere gradually cools, contracts, and moves away from the ridge, traveling across the seafloor to subduction zones. The existence of younger rock near these ridges is considered proof of continuous seafloor spreading.

Convergent oceanic plates overriding each other become heavier at one end and plunge as much as 62 mi (100 km) into the mantle. The edges of the plates melt from the intense heat and rise to the surface as molten rock. The colliding plates produce deep ocean trenches or subduction zones. Magma rises from the mantle to the ocean floor, creating continental rift valleys and plateaus of basalt. These processes create volcano mountain formations from lava accumulation on the ocean floor.

Transform-fault boundaries become earthquake zones because of plates sliding horizontally against

each other. Most of these faults found on the ocean floor are associated with divergent plate boundaries, while other trenches form convergent plate boundaries. Earth instability generates the tremors of plate movement.

The continental lithosphere is about 62 mi (100 km) thick, with a low-density crust and upper mantle. Because of their granite composition, continental plates tend to be more porous and thus float above the oceanic plates. When the heavier (stacked) oceanic plates plunge into the mantle, the continental plates move along with the oceanic plate movement.

Continents move laterally as convection cells move upward, away from hot mantle zones toward cooler ones. This process is known as continental drift. Continental drift was believed to occur when North America and South America split apart from Eurasia and Africa. Because of this split, the once-small ATLANTIC OCEAN is now the second-largest ocean, covering one-fifth of the Earth.

There are active fractures along the Mid-Atlantic Ridge that continually open and release lava flow. These rock-formed ridges continually move the continental plates by broadening the ocean basins. Another form of movement is when one continental plate overrides another. This type of movement, over periods of geologic time, forms high mountains on the Earth's surface.

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## orographic precipitation

OROGRAPHIC PRECIPITATION is caused or enhanced by one or more of the effects of mountains on the Earth's atmosphere. These effects include the upward or lateral motions of air directly caused by mountains acting as a barrier as well as the thermal effects of the mountains that cause them to be elevated heat or

cold sources. Mountains can generate both stratiform precipitation, which takes place in a statically stable atmosphere, and convective precipitation, which results from the release of static instability.

The most obvious effect of mountains is that they can cause the air encountering them to rise. Rising air cools adiabatically, and if it is sufficiently humid, condensation and perhaps precipitation can occur. Precipitation formed by this mechanism is widely referred to as upslope precipitation. It is widely recognized that the slope on the upwind side of the prevailing wind (the windward side) generally receives more precipitation than the leeward side. In contrast, some of the world's deserts are on the leeward side of mountain ranges. Because of interactions with other processes, however, there is no general rule about the location on the mountain slope where the maximum upslope precipitation will occur.

### SEEDER-FEEDER

Upslope precipitation may be enhanced by the seeder-feeder mechanism. A low-level stratus cloud (feeder cloud) forms near the top of a mountain. Its temperature is below freezing but warm enough so that it lacks ice nuclei. Ice crystals fall from a higher (and colder) seeder cloud into the feeder cloud. These ice crystals grow at the expense of the water droplets in the feeder cloud by the Bergeron process. The large ice crystals then precipitate out of the feeder cloud to the Earth's surface. This process increases the precipitation efficiency of the feeder cloud because the moisture from small water droplets, which otherwise would not have reached the Earth's surface, evaporates and is deposited on the ice crystals.

Mountains can generate precipitation through the release of static instability by providing a lifting mechanism for air parcels as well as by orographic processes that destabilize the air column. Precipitation can be generated by three categories of processes: orographic lifting, thermal effects, and obstacle effects. Orographic lifting can bring air to the Level of Free Convection (i.e., the level at which it becomes positively buoyant). If the atmosphere has a sufficiently thick layer above this level that is statically unstable, precipitation may result. Lifting of an air column can cause it to become more statically unstable.

The thermal effects of mountains occur because orographic features can serve as elevated heat or cold sources. During the day, the sun heats the mountain slope. It warms the air next to it, which then becomes warmer than the atmosphere at the same elevation

away from the mountain over lower land. Thus, there is low pressure next to the mountain toward which the air moves—producing upslope flow. This heating can be modified by surface conditions. Bare rock will transfer more sensible heat to the atmosphere than snow cover. At night the mountain surface cools, which causes the air above it to cool and results in air that flows down the slopes. Air moving across the mountain top during the day is heated by the mountain. This heating helps to destabilize the air column.

In addition, convergence (which promotes upward air motion) may be produced at the ridge crest as air flows up the slope from opposite directions. The combination of the heating and the heating-induced convergence can generate thunderstorms. At night, downslope winds from mountains on opposite sides of a valley can converge in the valley and encourage the generation of thunderstorms as well.

### THERMAL EFFECTS

Mountain ranges and high plateaus can have larger-scale thermal effects on precipitation. During the summer, heating causes low pressure to form near the surface over high elevation areas. Convergence into this low pressure area can encourage the formation of thunderstorms. Since heating is stronger during the day, the location of the lowest pressure varies diurnally. The changes in this location can affect the time of day that is most favorable for precipitation to form for a particular place in or near a mountainous region.

Mountains also act as obstacles to air flow and in so doing can encourage the development of convective precipitation. Convergence may be generated when air moves through a progressively narrower valley or when air moving around the mountain base arrives on the other side. These processes can cause moisture convergence as well and static stability is quite sensitive to atmospheric humidity.

Under stable static stability conditions, mountains may generate buoyancy waves—commonly known as gravity waves. These waves propagate downstream (and sometimes upstream as well) of the mountain. The parts of the wave that contain upward-moving air may aid in the development of convective storms, especially if they interact with other mountain-generated circulations such as the diurnal mountain-valley winds.

Orographic variations can contribute to the development of convective storms in their surrounding areas as well as in the mountainous area itself. As they interact with the large-scale wind field, mountains may generate downstream eddies in the flow under some

conditions. An example of such an eddy is the so-called Denver cyclone. Such a cyclonic circulation can have areas of convergence and vorticity that encourage the development of convective storms. Outflow from thunderstorms generated within the mountains may initiate convective storms in the surrounding lowlands.

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## Ottoman Empire

THE OTTOMAN DYNASTY created the most enduring empire in human history. The Ottomans originally migrated from Central Asia as nomads and settled in the early 14th century as a military Turkic principality in western Anatolia (present-day TURKEY), between the frontier zone of the Seljuk state and the Byzantine Empire. The Ottomans emerged into a dominant Muslim force in Anatolia and the Balkans and became the most powerful Islamic state since the breakup of the Abbasid caliphate in 1258.

At its height in the 16th and 17th centuries, the empire was the most powerful in the world. Made up of diverse ethnic and religious groups, including Arabs, Armenians, Greeks, Kurds, and Slavs, the empire stretched from Central Europe in the west to Baghdad (IRAQ) in the east, from the Crimean Sea in the north to the Upper NILE in EGYPT and the Arabian Peninsula (SAUDI ARABIA) in the south.

Named after the founder and first sultan (ruler) of the dynasty, the Ottomans came into prominence with their gradual invasion of the Byzantine Empire that had occupied parts of Asia Minor and southeastern Europe for nearly a thousand years. With the conquest of the Byzantine capital, Constantinople, in 1453 under the rule of Muhammad II (1451–81), famously known as "Mehmet the Conqueror," the Ottomans ex-

tended their dominance over much of Anatolia and southeastern Europe. Constantinople then became the capital of the Ottoman Empire and was renamed ISTANBUL. After taking Constantinople, the Ottomans, conquered the FERTILE CRESCENT, North Africa from Egypt up to MOROCCO, and the Arabian Peninsula, including the Hijaz, seizing control of the holy cities of Mecca and Medina. Under Suleiman the Magnificent (1520–66), they expanded into the Balkans in 1521, capturing Belgrade (SERBIA AND MONTENEGRO) and even besieging the Habsburg capital of Vienna (AUSTRIA), forming the largest and one of the most powerful empires of the 16th-century world.

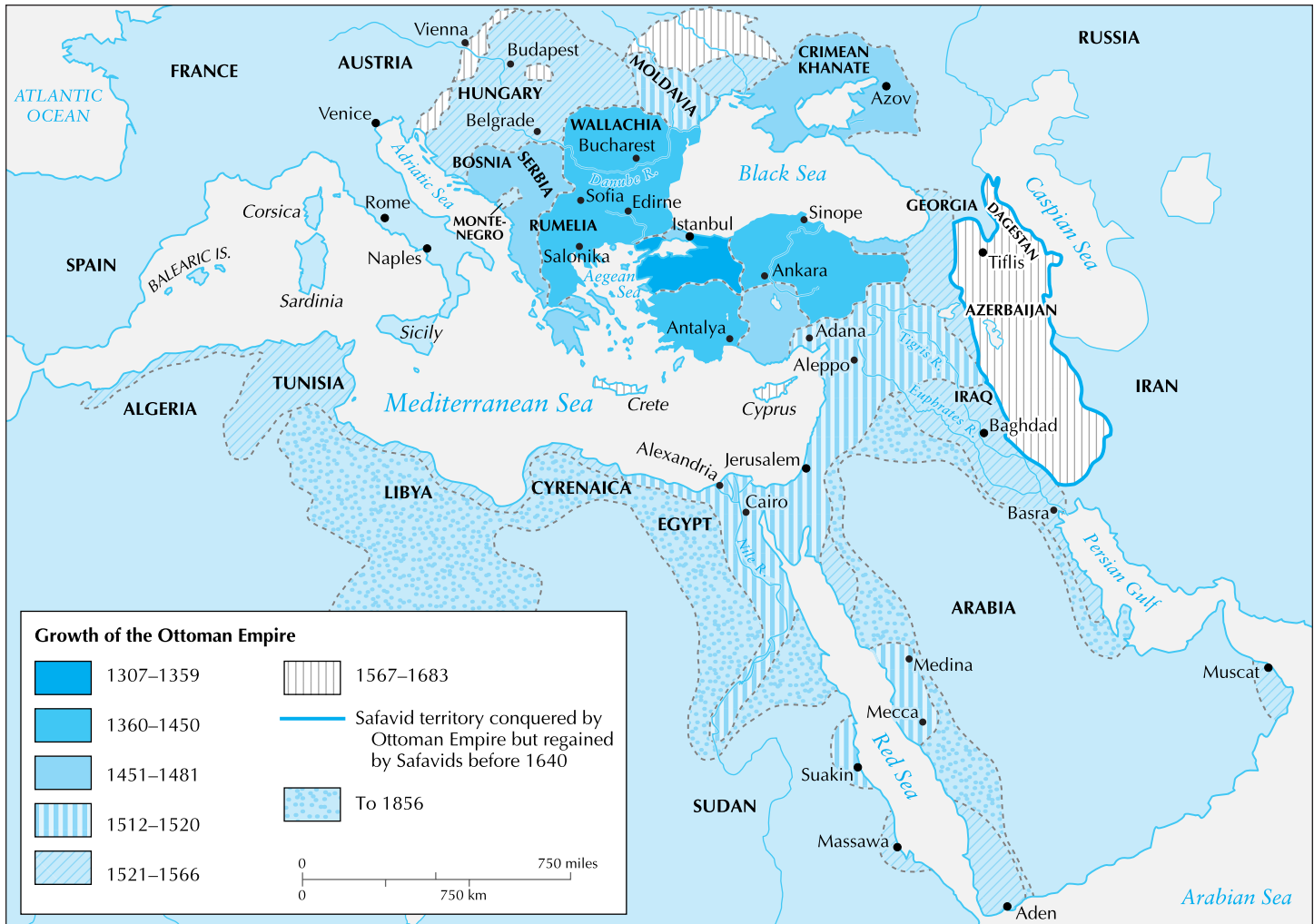
After the death of Suleiman the Magnificent in 1566, the Ottoman Sultans, also known by the Persian title of Padeshah, became increasingly dependent on the crops of Janissaries, captured Christian slaves trained into elite soldiers, and the clergy class or the ulama, who gradually gained power at the court. The Janissaries were not only a military organization that protected the sultan, but also a warrior, spiritual fraternity, an association inclined in the mystical dimension of ISLAM that upheld a chivalric code of ethics; they were a powerful elite body in the Ottoman Empire. Although the sultans made the important decisions for the empire, including exercising the power to appoint officials to collect taxes and maintain stability within the empire, the grand mufti, the chief religious cleric, legitimized the authority of the sultan as the ruler of the empire. In contrast to their contemporary Muslim states, the Safavids and the Mughals, the Ottoman Sultans shaped the clerics into a state bureaucracy rather than allowing them to evolve into an independent institution.

### OTTOMAN HIERARCHY

The Ottoman government was organized in the form of a hierarchy with the sultan in the top and ministers and advisors known as vizirs below him, followed by court officials and military officers. Central to the Ottoman sultanate was an organized bureaucracy drawn from the sultan's court that strictly controlled local provinces of the empire.

The empire was divided into two distinct classes. The ruling elites, primarily the imperial family, landowners, and military and religious leaders, ruled the conquered territories without paying taxes; whereas the ordinary Muslim population, mainly comprised of peasants and craft workers, paid an annual tax to the state in return for protection against invasion and abuse of power. The non-Muslim section of the





*At its height in the 16th and 17th centuries, the Ottoman Empire was the most powerful in the world. With the creation of Turkey in 1923, the oldest imperial power in the world was finally abolished and replaced by a secular republic.*

empire was divided into millets, which were administrative units set up on the basis of religious affiliation; they mainly included Armenian, Catholic, Orthodox Christians and Jews.

The Ottomans saw the first serious sign of the supremacy of Europe with the naval defeat of Lepanto in 1571 by the Spanish, the papal states of Italy, and the Venetians under John of Austria. Although Murad IV restored the Ottoman military in the 1638 victory over Safavid Persia, Vizir Kara Mustafa's army surrendered to Polish forces in 1683. The ensuing years saw the loss of Hungary and parts of the Balkan territories, such as the Mora Peninsula and Greece, through a 1699 treaty, after a series of defeats to various European powers, including the military forces of Charles V of Lorraine and Eugene of Savoy.

In the 18th century, the process of decline began to accelerate. Following the war of 1716–18 against Austria and Venice, the peace of Passarowitz led to the additional loss of the remaining parts of Hungary and Transylvania, including Belgrade.

### RISE OF RUSSIA

This marked the end of the Ottoman expansion into European territories—with the exception of the recapture of Belgrade in 1739. With the rise of Russia to power as a formidable opponent, the Ottomans faced further complications in the 18th century. The formation of Crimea (present-day Ukraine) into an independent region, along with the rise of various Danube principalities under the protection of Russia in the late 18th century, identified a major military weakness of

the Ottoman Empire, a weakness that led to further defeats by Karim Khan Zand of Persia (1776) and the war against the Russians.

The 19th century saw the beginning of reform and the gradual end of the dynasty. In this period, the increasing expansion of European powers into Muslim territories forced the Ottomans to initiate economic, military, and political reform. The tanzimat, the modernization reform movement, inaugurated an era that aimed to review the body of Islamic knowledge and the economic, social, and technological apparatus of the empire and adapt the Ottomans to the modern world. Although reforms were originally under way under the reign Sultan Selim III (1789–1807), in 1839 Sultan Abd al-Majid (1839–61) issued a decree including a significant set of civil reforms.

The reign of Sultan Abd al-Aziz (1861–76) saw the rise of new liberal political parties and the emergence of new elites and state bureaucrats to manage the changing economy and political system of the empire. The reforms marginalized the artisans, the merchants of the bazaar, and the travelodge or caravanserai, which had long supported the ulama and the sufi classes. The reforms also provided the empire with major technological transformations, such as the introduction of steam and electricity power, the telegraph, telephone, and eventually television communications.

In 1908 a group of Ottoman military officers, named the Young Turks, forced Sultan Abdul-Hamid II (1876–1909) to reinstate the imperial constitution, originally drafted in 1876 and long suspended because of the Russian invasion of 1877. The Young Turk movement then successfully managed to limit the au-

thority of the sultan as the supreme sovereign of the empire by expanding the authority of an elected parliamentary government.

With the outbreak of World War I, the Ottomans lined up with the Central Powers and faced a humiliating defeat as a result. After World War I ended in 1918, the empire was under the occupation of several Allied powers, including Britain and Greece. It was not until the Kemalist nationalist movement—named after its leader, Mustafa Kemal, famously known as Kemal Atatürk (1881–1938)—which ended the foreign occupation of Turkey in 1922, that the Ottoman Empire saw its demise. With the creation of Turkey in 1923, the oldest imperial power in the world was finally abolished and replaced by a secular republic.

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## Pacific Ocean

THE PACIFIC OCEAN HAS an area of approximately 68,767,000 square mi (178,106,000 square km) with its adjacent seas; 65,329,000 square mi (169,202,000 square km) without them. As the world's largest ocean, it has the following characteristics.

Volume: 160,489,000 cubic mi (674,052,000 cubic km) including adjacent areas; 158,065,000 cubic mi (663,871,000 cubic km) if they are not included.

Average depth: with adjacent seas -13,480 ft (-4,110 m); without them -14,038 ft (-4,280 m).

Greatest depth: -35,798 ft (-10,911 m) in the Challenger Deep in the Mariana Trench.

Width: varies from north to south reaching about 12,300 mi (19,800 km) between INDONESIA and the coast of COLOMBIA in South America.

Coastline: 84,300 mi (135,663 km); adjacent areas include the Bering Sea (in the north); the Gulf of California (in the east); Ross Sea (in the south); and the Sea of Okhotsk, the Sea of Japan, and the Yellow, East China, South China, Philippine, Coral, and Tasman seas (in the west).

Because the ATLANTIC OCEAN was home to extensive exploration and commercial use long before the Pacific, research on the Pacific is not as well developed as that on the Atlantic. The Pacific BASIN is almost triangular in shape, narrow in the Arctic north and broad in

the Antarctic south. In the west, it touches Asia and AUSTRALIA, while in the east it borders the Americas. Its north to south extent between the Bering Strait in the north and ANTARCTICA in the south is more than 9,300 mi (15,000 km). In the tropics, between the MALACCA STRAITS to PANAMA, the Pacific reaches its greatest width, spanning a distance of nearly 12,427 mi (20,000 km).

If you include all of its adjacent seas, the Pacific covers about one-third of the Earth's surface and 40 percent of the surface area of the world's oceans, an area greater than that of all of the continents combined. The boundary between the Pacific and INDIAN oceans follows a line from the Malay Peninsula through SUMATRA, JAVA, Timor, Australia at Cape Londonderry, and Tasmania. From Tasmania to Antarctica, it follows the meridian from the South East Cape on Tasmania at 147 degrees E.

The dividing line between the Atlantic and the Pacific follows the line of shallowest depth between Cape Horn and the Antarctic Peninsula. In the north, the boundary between the North Pacific and the ARCTIC OCEAN lies along the shallow shelf of the Bering Strait that extends between the Chukchi Peninsula in eastern SIBERIA and the Seward Peninsula in western ALASKA. There is also a boundary between the Pacific's northern and southern zones, formed by the equatorial counter-currents that circulate just north of the equator in an

area known as the Intertropical Convergence Zone (ITCZ).

### PHYSICAL FEATURES

Typically, the depth of the Pacific basin is only 1.8 to 2.5 mi (3 to 4 km), so the horizontal dimension of the basin is about 1,000 times greater than its vertical dimension. Another unique feature of the Pacific Ocean is its large number of seamounts, particularly in the Northwest and Central Pacific Basins. Seamounts are found in all oceans, but the volcanism of the northwestern Pacific Ocean produces them in such numbers that in some regions they cover a fair percentage of the ocean floor.

Because the rim of the Pacific Basin is ringed with volcanoes, it is often referred to as the RING OF FIRE. This ring, which extends from Alaska through the UNITED STATES, MEXICO, and South America, then on to NEW ZEALAND and up to JAPAN and RUSSIA includes about 75 percent of all the world's volcanoes.

In great contrast to the Atlantic, the Pacific contains thousands of islands. These are usually one of four basic types: continental islands, high islands, coral reefs, and uplifted coral platforms. In the west, there are a number of large islands such as Japan, TAIWAN, BORNEO, and NEW GUINEA. In the south, there is a cluster of smaller islands included in POLYNESIA that extend east as far as TAHITI. Further away still to the east are several isolated islands such as PITCAIRN, EASTER ISLAND, and the Galapagos, which is just 621 mi (1,000 km) west of ECUADOR in South America.

All of the Pacific's adjacent seas are grouped along its western edge. Some of them are large shelf seas, while others are deep basins. In contrast to the Indian and Atlantic oceans, adjacent seas of the Pacific Ocean have only a small influence on the hydrology of the main ocean basin. The Australasian Mediterranean Sea, the only Mediterranean-type sea in the Pacific Ocean, is a major region of water mass formation and an important element in the mass and heat budgets of the world ocean system. Unlike the CARIBBEAN SEA in the Atlantic, however, its influence on the Pacific's hydrology is of only minor importance.

In the Atlantic and Indian oceans, an interoceanic ridge system divides the basins into compartments of roughly equal size. In the Pacific Ocean, the ridge system runs close to the eastern boundary, producing divisions in the southeastern Pacific Ocean similar in size to those of the Atlantic and Indian basins. The vast expanse of deep water in the central and northern Pacific Ocean, on the other hand, is subdivided more by con-

vention than topography into the Northeast Pacific, Northwest Pacific, Central Pacific, and Southwest Pacific Basins. Further west, New Zealand and the Melanesian islands provide a natural boundary for two adjacent seas of the Pacific Ocean, the Tasman and Coral seas, while in the north the West and East Mariana Ridges and the Sitito-Iozima Ridge offer a natural subdivision.

### WATER AND CLIMATE

In the Pacific the systems of winds and currents follow a clockwise movement in the Northern Hemisphere and counterclockwise in the South. Between the two run the Equatorial Currents. The North Equatorial Current runs 9,000 mi (14,416 km) from PANAMA to the PHILIPPINES and is the longest westerly running current in the world. When the North Equatorial Current reaches Japan, it turns north and is known as the Japan Current. The Japan Current is the western Pacific's counterpart of the Gulf Stream in the Atlantic. When it meets the cold waters of the Arctic, fogs and storms are caused, just as they are at the meeting of the Labrador Current and the Gulf Stream. In the southern half of the ocean, the Humboldt Current flows north from Antarctica along the coast of South America.

At regular intervals a vast area of the Pacific's surface waters becomes warmer. This change in temperature and level causes an alteration in the pattern of the winds, a phenomenon known as EL NIÑO. As the warm water travels across the Pacific, it deflects the Humboldt Current near Peru and cuts off the food supply to plankton. The warmer waters along the coast of Peru also cause increased rainstorms and flooding in many parts of South and Central America. The monsoon rains in Southeast Asia are also interrupted, often leading to crop failures in Australia and New Guinea. Every time there is an El Niño, there is even crop damage as far away as Africa, where the maize crop in zimbabwe has been known to decline. On the other hand, in israel, El Niño years bring more rain and the crops are more abundant.

Few rivers shed their waters into the Pacific Ocean, and the few that do have very small catchments. The largest rivers all enter the marginal seas along the western rim of the North Pacific basin, where they have a strong impact on the hydrology. Although the rivers coming down from the mountain ranges are small, they are numerous and their combined freshwater output is comparable to that of the MISSISSIPPI RIVER. This also constitutes about 40 percent of all the freshwater input into the northeast Pacific Ocean. In the Southern



Hemisphere river contributions are negligible because the river catchments are restricted by the ANDES in the east and Australia's Great Dividing Range in the west.

## HISTORY AND ECONOMY

The Pacific is the world's oldest ocean. Theories of the Pacific's origin are related to PLATE TECTONICS, where movement of the land masses of the Earth are either drifting apart or sinking and sliding under one another. The role of humans in the Pacific has been the result of migration and exploration. The island peoples of MELANESIA, MICRONESIA, and Polynesia traveled extensively settling in Australia, New Zealand, Hawaii, and thousands of other islands.

People such as Thor Heyerdahl believe the migration might have been in the opposite direction because the sweet potato, a native plant of PERU, grew in Polynesia before the arrival of western explorers. The first European to see the Pacific was the Spanish explorer Balboa in September 1513. Later, Ferdinand MAGELLAN set sight on the Pacific after sailing round Cape Horn at the southern tip of South America in 1520. The first English explorers were Francis Drake in the 16th century and Captain James Cook in the 18th century.

Although there is no written proof, it is believed that ships from the great Chinese voyage of discovery under Zheng He may have sailed around Cape Horn sometime between 1421 and 1423 on the return trip to CHINA. For the remainder of the 16th century, Spanish influence was paramount, with ships sailing from SPAIN to the Philippines, PAPUA NEW GUINEA, and the SOLOMON ISLANDS. During the 17th century, the Dutch, sailing around southern Africa, dominated discovery and trade. The 18th century marked a burst of exploration by the Russians in Alaska and the ALEUTIAN ISLANDS, the French in Polynesia, and the British in the three voyages of James Cook.

The Pacific Ocean is a major contributor to the world economy and particularly to those nations its waters directly touch. It provides low-cost sea transportation between East and West, extensive fishing grounds, offshore oil and gas fields, minerals, and sand and gravel for the construction industry. One of the Pacific Ocean's greatest assets is fish, including herring, salmon, sardines, snapper, swordfish, tuna, and shellfish. Pearls are harvested along Australia, Japan, Papua New Guinea, NICARAGUA, Panama, and Philippine coasts.

## ENVIRONMENTAL ISSUES

There are a number of endangered marine species in the Pacific, including the dugong, sea lion, sea otter,

seals, turtles, and whales. Current major environmental issues include oil pollution in the Philippine Sea and South China Sea. There is also a zone of violent volcanic and earthquake activity known as the Ring of Fire surrounding it. Southeast and East Asia are subject to typhoons from May to December, while hurricanes may form south of Mexico and strike Central America and Mexico from June to October. The monsoon region lies between Japan and Australia in the far western Pacific. The greatest typhoon frequency exists within the triangle from southern Japan to the central Philippines to eastern Micronesia. The southern shipping lanes are subject to icebergs from Antarctica.

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## Pakistan

**Map Page** 1123 **Area** 310,413 square mi (803,940 square km) **Population** 150,000,000 **Capital** Islamabad **Highest Point** 28,251 ft (8,611 m) **Lowest Point** 0 m **GDP per capita** \$2,100 **Primary Natural Resources** natural gas, petroleum, coal, iron ore.



PAKISTAN CAME INTO being in 1947 when British colonial India, upon independence, was divided into

Muslim-dominated East Pakistan (BANGLADESH as of 1971) and West Pakistan. Its 97-percent-Muslim population is divided between 75 percent Sunni and 25 percent Ithna'Ashariya (Shia), with a few of Isma'ili and Ahmadis. Parsis (Zoroastrians) and Christians provide the remaining proportion.

The official language is Urdu, a blend of Hindi, Persian, and Turkic languages, but the dominant language is Indo-European Punjabi (65 percent of speakers), followed by Sindhi (15 percent), Baluchi (10 percent), and Pakhto/Pashto (10 percent). A remnant of Dravidian languages, Brahui, is still spoken in the mountains of Baluchistan. Many languages, almost all non-literate, are spoken in the mountainous north. Burushaski, a language heretofore not connected to any other extant language is still spoken in the Hunza and Yasin valleys in the northern areas. English is spoken by 10 percent of the population. The coastal city of Karachi has a population of almost 12 million, while the ancient Mughal city of Lahore has 5 million, the capital conurbation of Islamabad/Rawalpindi 2.5 million, and western cities of Quetta .7 million and Peshawar .25 million.

### GEOGRAPHIC CONNECTION

Although there is no direct cultural historical connection between the territory occupied by present day Pakistan with ancient times, there is a geographic connection. The INDUS RIVER civilization founded 4,200 years ago was one of the earliest civilizations, rivaling Mesopotamia and the NILE civilizations in cultural achievements, with archaeological sites such as Mohenjo Daro and Harappa yielding artifacts in bronze, glass, jade and lapis lazuli. The ancient history of the Indus region lasted until 1500 B.C.E. when Aryan invaders from Central Asia poured through the Hindu Kush-Himalayas and overran the remnants of the preceding civilization. These invaders became the dominant cultural feature of today's Pakistan, INDIA and Bangladesh. They composed the Rig Veda, the ancient sacred hymns. Persian intrusions were succeeded by Alexander of Macedon, who penetrated in 326 B.C.E. as far as the known world, the Beas River of the Punjab—the land of the five rivers.

Repeated invasions from Central Asia came from the Graeco-Bactrians from their redoubt in Balkh on the northern plains of today's AFGHANISTAN, and the Kushan kingdom based in Bagram north of present day Kabul, Afghanistan. Buddhist archaeological sites of that era include Taxila and Swat near Peshawar and Bamyan in Afghanistan.

The major impact in the first millennium C.E. was the invasion of Arabs and with them, Islam, which replaced Buddhism and Hinduism in many places. Later, in the 12th and 13th centuries, pillaging by invaders from the South Asian frontier, the crest of the Hindu Kush Mountains in present-day Afghanistan, continued to wrack northern regions of cultural India. Another Indo-Islamic period started in the 16th century, when Babur, a Central Asian now buried in Kabul, inaugurated the Mughal civilization, which lasted until it was replaced by the British East India Company in the 18th century. Great advancements were made in literature, the arts, land use, and egalitarian public life during this period.

Periodic battles with Sikhs in the Punjab lasted for several centuries. During the first half of the 20th century, Indian Muslims pressed for a state for Muslims. In 1947 this was realized when Pakistan was created under the premier Mohammad Ali Jinnah, a Bombay Muslim. Many Indian Muslims became émigrés in the new state of Pakistan. Political stability in Pakistan has been uncertain over the years since then because of excessive military and religious interference in civil affairs.

The Pakistani military, almost exclusively drawn from Pushtun and lesser Punjabi populations, repeatedly interfered with popularly elected civil authorities. Armed skirmishes with India in 1965 and 1971, and later in Kargil in the Karakorum mountains on the cease-fire line in 1999, continued the strife with India. In 1971, disaffection with West Pakistan led East Pakistan, composed from the Muslim districts of Bengal province, to secede after a civil war with West Pakistan authorities. The resulting nation-state of Bangladesh was created. Military and civil personnel continued to squabble for the next three decades with the military Inter-Services Intelligence (ISI) interfering in public policy debates. Continued low-level strife with India over the contested erstwhile state of Kashmir has not been resolved because India has refused to honor a United Nations mandate. Since the terrorist attacks of September 2001 in America, Pakistan has been a strong ally of the U.S. War on Terrorism, providing crucial geographic support for the American invasion of Afghanistan in 2002.

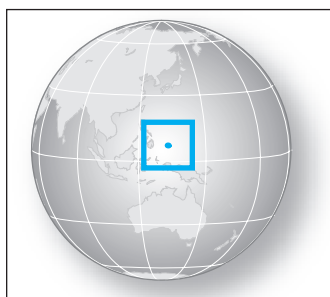
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## Palau

**Map Page** 1128 **Area** 179 square mi (458 square km) **Population** 19,717 **Capital** Koror **Highest Point** Mount Ngerchel-chuus 798 ft (242 m) **Lowest Point** 0 m **GDP per capita** \$9,000 (2001) **Primary Natural Resources** forests, minerals, gold.



PALAU (OR BELAU to its natives) is one of the world's newest nations, finally securing independence (in Free Association status) with the UNITED STATES in 1994 after nearly two decades of struggle. As part of the United Nations Trust Territory of the Pacific, Palau formed the westernmost component of the Caroline Islands but opted for separation in 1978 instead of joining the rest of that group as the independent Federated States of MICRONESIA. Today, known as one of the world's most attractive diving and snorkeling centers, Palau continues to develop its own identity separate from U.S. military requirements yet dependent on U.S. fiscal subsidies.

The Republic of Palau consists of six island groups, made up of a more than 300 islands, with a total coastline of 942 mi (1,519 km). The largest island, Babelthuap, dwarfs the others in size, and is the only one of the group with significant elevation. The rest are low coral islands, fringed by large barrier reefs. The chain stretches across 434 mi (700 km) of the western PACIFIC OCEAN, 496 mi (800 km) east of the PHILIPPINES. Originally two main confederations of chiefdoms, the islands were annexed by SPAIN in 1886, purchased by GERMANY in 1899, annexed by JAPAN in 1914, then occupied by the United States in 1945. Formally put under the jurisdiction of the United States as part of the Trust Territory in 1947, the islands were developed as an important naval station. This was a major cause for delay of ratification of Palau's independence, because of the locals wanted to be nuclear-free. The Free Asso-

ciation Compact that was finally ratified in 1993 provides Palau with up to \$700 million in aid over 15 years in return for continued use of military facilities for 50 years. Yet in August 2003, Palau joined with several other countries in signing a comprehensive Nuclear Test Ban Treaty, provoking a statement from the U.S. secretary of state that America would not rule out the possibility of future testing in Palau.

The population (mostly living in the Palau cluster) relies on industries related to tourism (services and craft items from shell, wood, pearls) and developing fisheries and garment industry. One of the largest agricultural products is marijuana. The constitution of 1979 was designed to incorporate both Western ideas of democracy and individual liberty and traditional forms of communal ownership and hereditary political systems. The people thus retain more of their indigenous culture than most postcolonial societies, highlighted by the fact that Palauans have the only active indigenous movement in Micronesia: the United Sect (Ngara Modekngei), practiced by about a third of the population. Palau's strength lies in this cultural heritage and the islands' remarkable beauty.

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## Pamir Knot

THE UNIQUE OROGRAPHIC feature known as the Pamir Knot takes its name from the mountains on which it is centered, the Pamir. The "knot" refers to the convergence of some of the world's major mountain ranges, including the TIAN SHAN, Karakorum, Kunlun, HINDU KUSH, and Pamir systems. The origin of the word *pamir* is unclear, although the Tajik name for the region is Bom-i-Dunyo, or "roof of the world." Other sources claim "feet of the sun" and the high altitude grasslands of the region as sources of "pamir." While a number of countries claim to be home to the Pamir

Knot, it is actually centered in the Gorno-Badakhshan autonomous region of eastern TAJIKISTAN. Fringe areas extend into AFGHANISTAN, PAKISTAN, CHINA, and KYRGYZSTAN.

In terms of relative location, the Pamir Mountains region remains one of the least accessible areas in the world. High peaks of the Pamir include Communism Peak (24,590 ft or 7,495 m), Lenin Peak (23,403 ft or 7,133 m), and Peak Evgenia Korjenskaya (23,311 ft or 7,105 m). In terms of mountaineering, these towering peaks have been scaled a number of times, although lesser peaks of the Pamir remain as yet unconquered. Considerable temperature variation exists within the Pamir region, with winter daily lows ranging from 1 degree F (-17 degrees C) in eastern areas to 21 degrees F (-6 degrees C) in the west. The Pamir region is heavily glaciated, including Murghab Pass, which stretches for 144 mi (231 km).

### GEOPOLITICS

This mountain region is also home to a number of geopolitically important features. The Karakoram highway, linking Gilgit with Kashgar, is the highest international highway in the world. The Wakhan Corridor, a narrow corridor (as narrow as 10 mi or 16 km) running through the Pamir mountains between Tajikistan and Pakistan, can be seen on political maps as the eastern "finger" of Afghanistan. This corridor was an annexation to Afghanistan by Great Britain in the late 18th century. The main purpose of the Wakhan Corridor was to thwart Russian advances toward British India during the Great Game. The Great Game, waged throughout the region, was an 18th century Cold War-style conflict between Britain and Russia for control of Central Asia. The Wakhan Corridor effectively separated British and Russian territory.

The Tian Shan mountain range radiates north from the Pamir Knot through the border region of Kyrgyzstan, Kazakhstan, and the western Xinjiang region of China. The range includes Pik Pobeda, the highest point in Kyrgyzstan, which rises to an elevation of 24,407 ft (7,439 m). The lengthy Kunlun mountains stretch for 1,863 mi (3,000 km) through western China, south to the Pamir Knot, and northeast through northern Tibet. The Kunlun range includes Kongur Tagh, rising to an elevation of 25,326 ft (7,719 m). The Hindu Kush mountain system stretches for over 559 mi (900 km) through eastern Afghanistan, forming much of the boundary with Pakistan. Notable peaks include Tirich Mir (25,230 ft or 7,690 m) and Nushaq (24,581 ft or 7,492 m). The Karakoram, stretching for

310 mi (500 km) through the border region of Pakistan, India, and China, is the westernmost range of the Himalayas.

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## pampas

THERE ARE MANY types of GRASSLANDS worldwide, especially in the continental interiors of temperate to subtropical regions. That of South America is known as the pampas, a Spanish term. The pampas occupies some 270,270 square mi (700,000 square km) in the countries of ARGENTINA, URUGUAY, and southeast BRAZIL. Here, there are extensive plains with isolated low hills in a region where the major drainage system is the River Plata. Climatically, average temperatures range from 43 to 79 degrees F (6 to 26 degrees C); only mild and short-lived frosts occur during the winter months (July and August), but summer temperatures can reach 104 degrees F (40 degrees C).

The pattern of precipitation mirrors that of other continental grasslands such as the North American prairies with an east-to-west gradient that ranges from 47 in (120 cm) to 17.5 in (45 cm). Although rain occurs year-round in the east, there is a concentration in the winter. Toward the mountains that border the pampas in the west, there is a concentration in the spring that is advantageous for new growth in an area that is semiarid. The geology comprises LOESS, a wind-blown sediment derived from volcanic ash, that gives rise to gray, brown, or black soils with high organic and nutrient content. They are fine-grained to the east and coarse-grained or sandy to the west, rich in calcium carbonate, and generally neutral or alkaline.

The vegetation communities are dominated by tall grass in the east, which benefits from a higher rainfall than the more arid west, where there are mainly medium- and short-grass communities. Herbs are present throughout, and where there is a local abundance of water, small woodlands occur. There are also wetlands of international importance. Species of the grass



*Stipa* are common throughout the region and the composition of the grass-herb-shrub communities depends on moisture and nutrient availability and topography. Most of the grasses form tussocks or clumps between which herbs and sedges grow. In the drier, western region, many of the species are xeromorphic (that is, tolerant of drought), and biodiversity is reduced compared with the eastern pampas. Here the grasslands merge with semidesert communities that occupy the rainshadow area created by the Andes. Locally, where soils are salt-rich, there are salt-tolerant species, that is, halophytes.

### PLANT SPECIES

There are few plant species that are endemic (native to the pampas) and considerable changes have occurred since the advent of the Europeans in the 1500s and 1600s. First, many introduced species have become naturalized, including clover and numerous grasses from Europe, and these have replaced native pampas species.

Second, there has been much land-cover transformation, especially in the east, as the natural ecosystems have been replaced by agricultural systems. This area is particularly suited to the cultivation of maize (corn) and wheat and to cattle ranching, though resulting environmental problems include soil erosion, which is linked to overgrazing, and pollution from the overuse of fertilizers. The crops and meat produced are very important to Argentina's economy. Apart from the home market, they are major exports and generate significant foreign income.

While much emphasis is usually placed on the plant communities of the pampas, the animal communities can be overlooked despite the fact that there are several endemic animals. These include the pampas deer and various birds such as Olog's gull, the curve-billed reedhaunter, and the pampas meadowlark, all of which are in danger of extinction. Other animals of the pampas include the guanaco, rhea, puma, geoffroy's cat, and the pampa fox, though many are rare and their populations are diminishing as their natural habitats are reduced.

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## Panama

**Map Page** 1136 **Area** 30,193 square mi (78,200 square km) **Capital** Panama City **Population** 2,960,784 **Highest Point** 11,400 ft (3,475 m) **Lowest Point** 0 m **GDP per capita** \$6,200 **Primary Natural Resources** bananas, rice, corn, coffee, sugarcane.



The Republic of Panama is a Central American country bordered both by the CARIBBEAN SEA and the PACIFIC OCEAN, between COLOMBIA and COSTA RICA. Slightly smaller than the state of SOUTH CAROLINA, the most dominant feature of the Panamanian landscape is the highlands, which form the continental divide through the center of the country. The highest constant elevations of the hills and mountains known as the Cordillera de Talamanca and the Serranía de Tabasará that create the continental divide are near Panama's borders, while the lowest elevations are along the Panama Canal, where most of the country's population is concentrated.

The country's Caribbean coastline has an abundance of natural harbors, but the only one that is significantly developed is located at Cristóbal, one of the terminuses of the Panama Canal, connecting the ATLANTIC and Pacific oceans. The port of Balboa is the major trading city on the Pacific coastline, which does not have an abundance of good natural harbors as a result of extraordinarily shallow waters and an extreme tidal range. Panama has almost 500 rivers, some of which provide crucial reservoirs of water for the canal and generate significant quantities of hydroelectric power.

Panama's climate is tropical, and temperatures and humidity remain high throughout the year, with little seasonal variation, usually remaining between 75 and 87 degrees F (24 and 32 degrees C). Temperatures on the Pacific side of the highland chain are typically lower than the Caribbean. In the highlands themselves, some areas experience temperatures that are quite cooler, and frosts occur occasionally in the Cordillera de Talamanca in western Panama.

Unlike temperature, rainfall throughout Panama varies substantially from 39 to 118 in (100 to more than 300 cm) per year. The overwhelming majority of the rains come during a marked rainy season, which usually lasts from April to December. The amount of

rainfall is determined by two factors in general: moisture from the Caribbean and the windshield effect of the continental highlands. Consequently, rainfall is much higher on the Caribbean side. In addition, the country is located outside the hurricane track, but is known to suffer from volatile thunderstorms.

Panama boasts a relatively strong economy, based upon its governmental stability and control over the PANAMA CANAL, which was turned over to Panama by the United States at the end of 1999. A well-developed service sector makes up the majority of its economy, mostly stemming from the Panama Canal, which continues to make its mark upon Panamanian history. Originally, U.S. plans for the Panama Canal provided the impetus for Panama's succession from Columbia in 1903, after which the new country was immediately recognized by the United States and an agreement for the commencement of construction was signed. Now, control over the canal permits Panama to continue to dominate trade in the region, as well as flagship registration and, more recently, tourism.

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## Panama Canal

A CANAL THAT LINKS the ATLANTIC and PACIFIC oceans through the isthmus of PANAMA from northwest to southeast, the Panama Canal is 51 mi (82 km) long. A trip through the canal takes approximately eight hours. The Panama Canal consists of a system of six locks that help ships negotiate the water levels of the canal. On the Atlantic side are the three locks at Gatun, and on the Pacific side are a lock at Pedro Miguel and two locks at Miraflores. The locks are in six pairs so that ships can travel in opposite directions. The locks are 1,000 ft (300 m) long and 110 ft (33 m) wide. The Panama Canal was formerly part of the Canal Zone, a 10-mi (16-km) strip of land that was under the jurisdiction of the UNITED STATES from 1903 until 1999.

The desire to find a shortcut from the Atlantic to the Pacific stretches back to at least 500 years ago. The

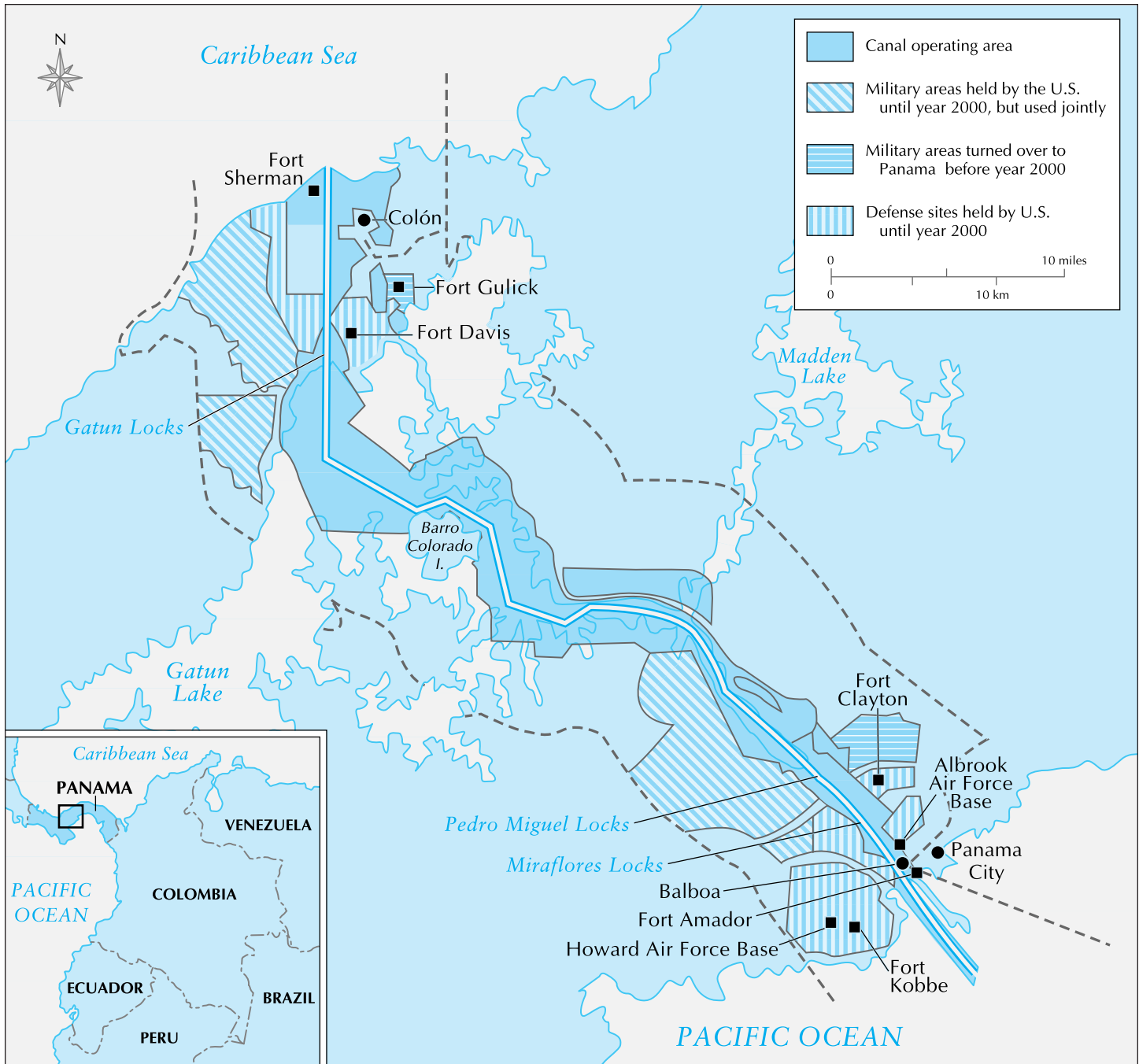
reality of construction on a canal began in 1880 when Ferdinand de Lesseps, who oversaw construction of the Suez Canal, gained a concession from the Colombian government, which ruled Panama, to begin work on the canal. However, after eight years, de Lesseps's plan ended in disaster as a result of poor planning, disease, and political upheavals. In 1889, de Lesseps's company declared bankruptcy and operations were turned over to the New Panama Canal Company in 1894. The same problems of disease and worker unrest also plagued the new owners, and after 1898, the New Panama Canal Company sought out potential buyers to take over construction.

The United States had been interested in constructing an isthmian canal since the early 19th century. In 1850, representatives from the United States and Great Britain signed the Clayton-Bulwer Treaty, which stated that neither the country would have sole ownership or defense of any future canal through Panama. By the end of the 19th century, the United States began its imperial expansion. The Clayton-Bulwer Treaty was replaced by the Hay-Pauncefote Treaty in 1901, giving the United States the sole monopoly on an isthmian canal and smoothing relations with Britain. In 1902, the United States began negotiations with COLOMBIA over the purchasing of the rights from the New Panama Canal Company to build the canal.

The Colombian government, however, rejected the Hay-Herrán Treaty because it would lose money in the long term. On November 3, 1903, a revolt erupted in Panama, and it declared its independence from Colombia, with American support. Thus, the United States was in a better position to negotiate for a canal treaty. Under the Hay-Bunau-Varilla Treaty, signed on November 18, 1903, the United States gained the Canal Zone and sole administration and defense of the canal "in perpetuity."

### BUILDING THE CANAL

The building of the Panama Canal is considered one of the great engineering feats of history. Construction began in 1904 under the Army Corps of Engineers led by George W. Goethals. In order to compensate for the varied terrain and the unnavigability of Panama's rivers, the Chagres River was dammed, creating a human-made lake 85 ft (278 m) above sea level, later named Lake Gatun. Ships entering from the Atlantic would enter the Gatun Locks to get to the lake. The Gaillard Cut was then constructed for the sharp descent to the Pacific. The number of laborers it took to build the canal totaled some 17,000, mostly from the



The Panama Canal links the Atlantic and Pacific oceans through the isthmus of Panama from northwest to southeast and is 51 mi (82 km) long. A trip through the canal takes approximately eight hours.

Caribbean. Another obstacle to overcome was eradicating disease, which was the undoing of previous attempts to build the canal. Under William C. Gorgas, the U.S. Army eradicated diseases such as yellow fever and malaria by destroying nesting areas of mosquitoes. The project cost \$380 million and lasted about 10 years. The Panama Canal opened in August 1914.

The people of Panama were never satisfied with their relationship with the United States regarding the Panama Canal. After negotiations during the 1960s and 1970s, a new treaty replaced the Hay-Bunau-Varilla Treaty, whereby the United States would gradually hand over control of the canal to Panama. In 2000, Panama gained full control over the canal. Issues from

the American control of the canal remain, however, such as the cleanup of the ecological damage in the Canal Zone and unexploded ordnance from former test sites.

The Panama Canal contributes about 7 percent to Panama's gross domestic product. In 2001, revenues from the canal came to \$215.2 million from annuities, tolls, dividends, and aid from the United States. The majority of the traffic that goes through the canal is from East Asia to the eastern United States. The countries that use the canal heavily are the United States, JAPAN, CHINA, CHILE, South KOREA, and PERU. During the 2002–03 fiscal year, 11,725 oceangoing vessels transited through the Panama Canal. Use of the canal has been declining in recent years because of the ever-increasing size of ships being constructed that cannot fit into the locks. To solve this problem, the government of Panama has begun work on widening the Culebra Cut and deepening the Gatun Lake channel and is considering building a third set of locks.

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## Pannonian Plain

ALSO KNOWN AS the Hungarian Plain, the Pannonian Plain is one of the flattest parts of Central Europe and one of the most agriculturally productive. The plain occupies a wide depression between the Alpine ranges to the west and south and the Carpathian chain to the north and east. At its greatest extent, the plain covers all of HUNGARY, eastern AUSTRIA, northern CROATIA and SERBIA, and southern CZECH REPUBLIC. The central feature, the DANUBE RIVER, divides the plain roughly in half, with the larger portion forming the Great Hungarian Plain to the east (known as the Alföld), and the smaller portion, the Western Lowlands (or the Little Hungarian Plain, the Kisalföld). To the south, the plain merges into the more hilly terrain of

the Balkan Peninsula (where the DANUBE merges with its largest tributaries, the Tisza, the Mur, the Drava and the Sava), while the west rises slightly in elevation at the foothills of the ALPS on the frontier with Austria.

The Danube floodplain south of Budapest can reach 12 to 19 mi (20 to 30 km) in width. A high rise between this floodplain and that of the Tisza River to the east is also a division between the eastern and western portions of the plain. This elevated ridge (only about 165 ft or 50 m) is mostly formed of sand dunes and LOESS hills, such as those at Gödöllő or Nagykörös. Several million years ago the area was covered by the Pannonian Sea, which accounts for the richness of its soil, formed from organic sedimentary deposits, at points a kilometer thick. The western segment of the plain still includes a large water-filled depression, Lake Balaton, which, at 233 square mi (598 square km) is the largest lake in Europe in area (though not in volume, since it is very shallow). The eastern plains spread out for miles of almost completely horizontal fields and grasslands, or *puszta*, with rich soil formed from alluvium deposited by the Danube and Tisza rivers. This region is sparsely settled, populated instead by herds of horses and cattle, and covered with farms.

The plain takes its name from the Roman province of Pannonia. This frontier province along the Danube was established in 9 C.E. but not really settled until the early 2nd century by Trajan. The Romans built cities like Vindobona (Vienna) and Aquincum (Buda), but the province was settled not by Romans, but by waves of "barbarians" from the east: Ostrogoths, Lombards, Avars, Huns, Slavs, and finally by Magyars, better known today as the Hungarians.

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## Pantanal

LOCATED IN SOUTH-CENTRAL BRAZIL and extending into the adjacent parts of BOLIVIA and PARAGUAY, the Pantanal is the world's largest wetland. It can expand during the rainy season to cover about 77,000 square mi (200,000 square km), which is about



one-third the size of FRANCE. Water depths may exceed 18 ft (6 m), with only the highest ground escaping inundation at this time. Water levels recede about 13 ft (4 m) during the dry season.

Rainfall in this part of South America totals 40 to 60 in (100 to 150 cm) per year, most of it concentrated in the hot months of November to April. The climatic impact of the Pantanal extends far beyond its boundaries. It acts as a giant sponge, receiving rainfall during the wet season and then releasing moisture to the atmosphere during dry spells. Climatologists assert that nearby areas would become less habitable if it were not for this store-and-release mechanism.

The Pantanal is an immense reservoir of biological diversity. It contains an astounding variety of plant life. Floating plants cover huge areas. A rich layer of silt supports many aquatic plants. On higher ground, bushy vegetation called cerrado predominates. Palm trees and fig trees punctuate these landscapes. Trees may form galleries along the banks of some rivers (gallery forests).

The aquatic vegetation supports large numbers of animals. Scientists have already identified over 650 species of birds such as the colorful macaw, 250 species of fish, 80 mammals, and 50 reptiles in this ecological paradise. Aquatic birds such as ducks filter small animals and algae from the water. Herons have established large colonies in trees along the riverbanks. They and storks feed primarily on fish, frogs, snails, crabs, and insects. The Pantanal is home to thousands of varieties of butterflies and a myriad of other insects. Larger animals living here include capuchin and howler monkeys, tapirs, capybaras, giant river otters, jaguars, caimans, and anacondas.

Despite the difficulty of access in this part of South America, the region's resources have attracted a great deal of attention, not all of it welcome. For example, poachers unlawfully kill caimans for their skins and capture macaws for export to Northern Hemisphere customers. Although reptile-breeding farms have helped reduce the illegal export of caiman skins, the Brazilian government lacks the resources to effectively combat the poachers. The arrival of commercial fishing boats, supported by refrigerated trucks, has complicated the problem of protecting natural resources here.

In addition, cattle ranchers have recently expanded operations on the margins of the Pantanal. The ecological impact of about 4 million cattle on these ranches has been considerable. For example, ranchers have removed cerrado vegetation from interfluvies, leading to increased silting of rivers such as the Taquari. Farmers

wishing to cultivate rice, sugarcane, and soybeans have also had a negative impact upon the natural environment. Mercury pollution from gold mining and sewage from nearby cities such as Cuiabá add to the problem. Fish absorb the toxic mercury, which is then passed up the food chain by fishermen and fish-eating birds.

The Pantanal is drained by the Paraguay River to the south and by tributaries of the AMAZON RIVER to the north. Cable News Network reported in April 1997 that engineers have proposed dredging a waterway to connect the two river systems. Proponents say that the proposed Hidrovia project would lower transportation costs and provide a vital transportation link between members of the MERCOSUR trading block.

Opponents assert that the project would be an ecological catastrophe, draining the Pantanal, killing many of the area's plants and animals, and negatively impacting the Native Americans living there. So far, the Brazilian government has yet to approve the Hidrovia project.

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## Papua New Guinea

**Map Page** 1128 **Area** 178,707 square mi (462,840 square km) **Population** 5,295,816 **Capital** Port Moresby **Highest Point** 14,793 ft (4,509 m) **Lowest Point** 0 m **GDP per capita** \$2,400 **Primary Natural Resources** gold, silver, copper, natural gas, timber.



PAPUA NEW GUINEA IS an archipelago that includes the eastern half of the equatorial island of New Guinea, which lies between the Coral Sea and the South PACIFIC OCEAN, east of INDONESIA and north of

AUSTRALIA. The country also encompasses much of the Bismarck Archipelago, including the islands of New Ireland and New Britain and the northernmost island of the SOLOMONS chain, Bougainville. The region has a monsoonal climate, with the wettest season lasting from December to March. Port Moresby, the capital of southern New Guinea, receives 39 in (1 m) of rainfall annually, while western New Britain regularly sees more than 20 ft (6 m) of rainfall per year.

The island of New Guinea was populated by migrants from Asia some 50,000 years ago. Evidence of complex human societies based on irrigated agriculture dates from 9000 B.C.E. Portuguese and Spanish explorers visited the area during the 16th century, but the island's size, large population, and difficult climate limited Europeans' advances. Dutch officials asserted their control over the western half of the island in the early 1800s, and it eventually became part of modern Indonesia.

GERMANY and the UNITED KINGDOM established claims over the eastern half of New Guinea in the 1880s, and Britain transferred its sector to AUSTRALIA in 1906, renaming it Papua. Germany lost its sector to Australia during World War I, and under an international mandate Australia governed the eastern half of the island. Much of it was seized by the Japanese, who also took control of the outlying islands, in World War II. After the war, New Guinea and many of the associated islands again were overseen by Australia, which guided them to full independence in 1975 as Papua New Guinea.

New Guinea is the world's second largest island, after GREENLAND. It is a geologically complex island dominated by rugged interior mountain ranges, high plateaus, and precipitous valleys, while its coastal areas feature powerful rivers, reedy deltas, and mangrove swamps. On the southwestern coast the country's longest river, the Fly, rises in the Victor Emmanuel mountains and flows through forested gorges before crossing plains and swamps. At its estuary it is 33 mi (53 km) wide. Also in the west is Lake Murray, the country's largest lake, which grows to five times its usual 400 square km (155 square mi) during the rainy season. In the northeast the great Sepik River travels 700 mi (1,126 km). With no natural delta, it deposits silt as far as 31 mi (50 km) out to sea.

The major islands of New Britain, New Ireland, and Bougainville, east of New Guinea, are part of an active volcanic formation known as the RING OF FIRE. The islands are surrounded by some of the largest coral reef complexes in the world. In 1994, 1997, and 2002,

New Britain's principal city, Rabaul, was devastated by eruptions of the nearby volcano Tavurvur.

Papua New Guinea hosts 9,000 plant species, 700 species of birds, and some 200 species of mammals. Intensive logging of its rainforests and heavy metals pollution from mining operations, particularly on New Guinea and Bougainville, present difficult environmental challenges.

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## Paraguay

**Map Page** 1141 **Area** 157,047 square mi (406,750 square km) **Population** 6,036,900 **Capital** Asunción **Highest Point** 2,762 ft (842 m) **Lowest Point** 151 ft (46 m) **GDP per capita** \$4,300 **Primary Natural Resources** cotton, sugarcane, soybeans.



THE REPUBLIC OF PARAGUAY is a LANDLOCKED country located in the central region of South America bordered by BOLIVIA, ARGENTINA, and BRAZIL and is slightly smaller than the state of CALIFORNIA. Paraguay is divided by the Rio (River) Paraguay into the eastern Paranena region and the western Chaco region. In the Paranena region, lands range from low plains to mountains, with the highest elevations occurring near the border with Brazil.

The Chaco region consists of a vast low-lying plain that makes up more than 60 percent of Paraguay's territory. Near the Rio Paraguay, the plains are quite marshy, while at the interior, they are dry and often parched from drought.

As a result of being landlocked, Paraguay depends upon the navigable Rio Paraguay for most of its trade, which flows through to BUENOS AIRES, Argentina.

Paraguayan foreign policy is mostly dominated by Argentine decisions.

The climate is tropical and subtropical but becomes more temperate toward the south of the southern portions of the country. The Parana region is notably humid and has abundant rainfall, which is distributed in relatively equal amounts throughout the year. In contrast, the Chaco region has a clearly distinguishable wet and dry season. The lack of efficient drainage renders the Chaco region susceptible to flooding. Temperature variations are modest, ranging between hot and humid to mild and damp.

Paraguay's population is mostly concentrated in the southern part of the country. The government is based at the capital of Asunción, which has a special government status, and the remainder of the country is separated and administered into 17 departments. The country is governed by a strong executive who shares authority with a bicameral legislative branch and a supreme court, all of which was established by the most recent national constitution, signed on June 20, 1992.

## HISTORY

The acceptance of the constitution marked a return to democratic government, following 35 years of military dictatorship, led by Alfredo Stroessner. Paraguay's history has almost always been marked by conflict, whether it is political infighting or border disputes.

The War of the Triple Alliance, which lasted from 1865 to 1870, proved disastrous for Paraguay, which lost much of its territory and more than two-thirds of its adult males as a result. Following the horrific costs of the war, Paraguay remained stagnant for well over a half-century, until it was able to invade some Bolivian lands and to retain them following the settlement of the Chaco War, which lasted from 1932 to 1935. Even after the conclusion of the major wars in which Paraguay participated, government instability still reigned, allowing Stroessner to seize power for over three decades.

Paraguay's economy is market-based but dominated by a large informal sector, made up of thousands of microenterprises and street vendors. The majority of the population is able to survive as a result of their own family-level agricultural activity that generates enough for subsistence. Even though the formal economy has continued to grow at modest levels, most international observers blame political corruption, uncertainty about reform, and substantial debt for the lack of a stronger and more positive growth.

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## Paris

PARIS IS NOT ONLY the capital city of FRANCE, it is also the largest city in the country. The census of 1999 showed that although the city itself, which covers 40.5 square mi (105 square km), is relatively demographically small by world standards, having a population of about 2.15 million, the greater Paris metropolitan (*aire urbaine de Paris*) population is significantly larger. In 1999, it was shown to be almost 11.2 million people. In terms of its administration, the city of Paris is broken into 20 districts or *arrondissements* that are each governed by elected councils. Each *arrondissement* has its own mayor, and some local council members are also members of the Council of Paris, which serves as a municipal government and general council of the Paris *département* (Paris political region). Today, Paris is not only at the forefront of the French economy but also that of Europe. With its many skyscrapers in the La Defense area, Paris has a financial core that can rival that of other European powerhouses. Much of the city's industry is based in the service sector and many multinational companies can be found within the city.

Paris has a long history—the name being derived from the Parisi peoples, a Gallic tribe who resided in the area at the time of the Roman conquest in 52 B.C.E. Upon invading France, the Romans named the Parisi settlement Lutetia, "marshy place," although within a handful of decades the settlement had another new name, Paris. Historically, Paris has centered upon a small island within the Seine River that is known as the Île de la Cité, today the site of the Notre Dame Cathedral, while urban development first took place on the left bank (*rive gauche*) of the Seine, which meanders through the settlement.

While the history of the city is long and at times bloody, it should be understood that the settlement's prosperity from the Middle Ages was closely tied to trade and cultural developments. From this age, the city has become known as an intellectual center that was highlighted from as early as 1257 with the found-





*Paris is centered upon a island in the Seine River that is known as the Île de la Cité, today the site of the Notre Dame Cathedral.*

ing of Sorbonne University (formerly known as the University of Paris). However, Paris is almost equally famous for its turbulent history, none more so than during the French Revolution (1789), the Franco-Prussian siege (1870), the Paris Commune (1871), and World War II (1939–45).

Topographically, Paris is generally flat because it lies on the former flood plain of the Seine River, although a number of prominent hills exist within its bounds. These include the hills of Belleville and Montmartre, the latter area famous for impressionist painting during the late-19th century and for the Basilica of the Sacré Coeur, which can be seen from almost all areas of the city. In terms of sophistication and art, few cities can match Paris and many of its museums are world famous for their collections. Visually, too, few cities can compare with Paris, with its large classical buildings scattered throughout the city and the vast sways of buildings erected alongside broad boulevards under the redevelopment project of Baron Georges-Eugène Haussmann during the 1850s and 1860s.

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## peninsula

A PENINSULA IS AN area of land that projects out into a body of water that surrounds it on three sides. Some peninsulas, like Baja California, are joined to the mainland only by a narrow neck of land called an isthmus. Others, such as INDIA, are connected to the mainland by a wide area of land. A cape is similar to a peninsula, but it is shorter and smaller. Some areas have many peninsulas and others have few. Peninsulas and islands make up more than one-third of Europe's area. Kenai Fjords, in ALASKA, is made up of many jagged peninsulas formed by the ice fields. As the glaciers in the area recede, the fjords deepen. This enlarges and exposes the peninsulas that reach out into the sea.

Peninsulas are formed in other ways, too. In some areas along the shores of the ocean, limestone and clay form the foundation of cliffs. Capes and peninsulas are formed as erosion wears away some of the clay and limestone. The higher the shore and the harder the rock is, the slower the rate of abrasion will be. Some peninsulas are formed when mud and sand are deposited between a series of islets, making a solid land mass. Others are formed by rivers. Erosion sometimes causes a peninsula to break off from the mainland and form an island.

The Arabian peninsula is the world's largest peninsula. It is made of crystalline rock that developed the same time the ALPS did. The Arabian Peninsula used to be joined to North Africa. When geologic movements caused a fault in Africa, called the Great Rift, the RED SEA was formed. The Great Rift runs from the Jordan valley to Central Africa. Geologists believe the whole peninsula is rotating slowly counterclockwise and in about 10 million years, the Persian Gulf will be closed off and become a lake. The country of SAUDI ARABIA takes up over half the area of the Arabian peninsula, but it shares the peninsula with other countries. They are JORDAN, ISRAEL, LEBANON, SYRIA, KUWAIT, BAHRAIN, QATAR, UNITED ARAB REPUBLIC, OMAN, and YEMEN.

The FLORIDA Peninsula reaches from the mainland of the UNITED STATES out into the ATLANTIC OCEAN and the Gulf of Mexico. It is a limestone plateau, formed many years ago when the area was covered by a shallow sea. The limestone, which is several thousand feet thick, is made up of the bodies of tiny sea creatures deposited over a period of millions of years. The limestone in Florida is only 50–60 million years old, compared to limestone in Kentucky, which is 430 million years old. The Florida limestone is very soft and very white.



Scientists say that about 200 million years ago, Africa and North America collided, then drifted apart again. A piece of Africa broke off and became the basis for Florida, deep under the ocean. It was on this piece of land that the limestone built up. About 30 million years ago, enough land had been formed to rise above the level of the ocean. During the past 30 million years, Florida has alternately been covered with salt water and been dry land. Today Florida's position between the Atlantic Ocean and the Gulf of Mexico, combined with its pleasant warm climate, has made it a prime tourist area. Many retirees relocate to Florida every year.

On the opposite side of the United States is a very different peninsula, called Baja California. The Baja Peninsula is part of Mexico. This is a long narrow peninsula extending south from the American state of California. Some scientists think that it used to be part of the mainland of MEXICO. They believe a rift developed and the peninsula moved away from the mainland. This took tens of millions of years. The gap filled with water and became the Gulf of California. Baja California developed its present shape during the last 5–10 million years. The peninsula tilted westward, forming fault block mountains. It is believed that the Baja Peninsula will eventually become an island.

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## Pennsylvania

THE COMMONWEALTH OF Pennsylvania, also known as the Keystone State, is located in the north-eastern UNITED STATES. With a total area of 46,058 square mi (119,290 square km), Pennsylvania extends 307 mi (494 km) from east to west and 175 mi (282 km) north to south. It is bordered by NEW YORK and Lake ERIE to the north, WEST VIRGINIA and OHIO to the west, NEW JERSEY to the east, and MARYLAND, West Virginia, and DELAWARE to the south. The state, made up of 67 counties, is an industrial leader in the country

and is famous for its many historical, cultural, and recreational sites, including Gettysburg, Amish Country, the Poconos, Independence Hall, Fallingwater, and Fort Necessity. As of 2003, Pennsylvania ranked sixth in the nation in population, with an estimated 12,365,500 residents. The most common ancestral heritages reported by Pennsylvanians are German, Irish, Italian, and English. Ten percent of the population is African American. Pennsylvania has a moderate climate with hot and humid summers and cold and snowy winters. Harrisburg is the state's capital.

Pennsylvania's diverse economy is dominated by the service sector, contributing 74 percent of the state's gross product. After the decline of the steel-making industry, the state had to adjust its manufacturing sector which now makes up 20 percent of the gross product. Food processing, chemical production, and electrical equipment dominate this part of the economy. Agriculture—dominated by livestock and dairy—and mining, mainly of petroleum, iron ore, natural gas, and coal, contribute 1 percent each toward Pennsylvania's gross product. One notable agricultural product activity is the harvesting of mushrooms in the southeast part of the state. Pennsylvania is the only producer of anthracite coal in the United States. However, the more common bituminous coal is also extracted.

In the early 1600s, Dutch sailors were the first Europeans to explore Pennsylvania. At the time of European arrival, native tribes in Pennsylvania included the Lenape, Susquehannock, Monongahela, Shawnee, Huron, and Erie. The first European settlement, south of present-day Philadelphia, however, was Swedish. While there were territorial disputes between the Swedes and the Dutch, England eventually took over the territory. King Charles II made a royal charter for Pennsylvania, or "Penn's Woods," in 1681 and named the colony after Admiral Sir William Penn, the father of the founder of the state, William Penn. Penn, a member of the Society of Friends, or Quakers, became the caretaker of the new colony and wanted Pennsylvania to be a refuge for the persecuted Quakers in England. Penn set up Philadelphia as the first permanent English settlement in Pennsylvania.

Soon after this time, the French began to build forts in western Pennsylvania, but they were eventually all taken over by England. During the American revolutionary efforts against Great Britain, Philadelphia became the capital of the new country. Pennsylvania later became a state in 1787. The economy expanded in the 1800s with Pittsburgh and Philadelphia evolving into important shipping hubs. The first oil well in the world

was drilled at Titusville in 1859 by Edwin Drake. Pennsylvania additionally benefited greatly from the Industrial Revolution and the two World Wars. With many coal sources within and near Pennsylvania, the commonwealth, especially the city of Pittsburgh, became the heart of the American steel industry, managed by entrepreneur Andrew Carnegie.

Pennsylvania's natural environment has changed drastically from the time of European arrival. The state has many old, winding rivers, and most of the state is hilly with plateaus, ridges, and valleys. Most of the lakes are man-made, and three-fifths of the state is covered by forests. Pennsylvania can be divided into seven main landform regions. Starting in the southeastern corner of the state, there is the Atlantic Coastal Plain, a small strip of low-lying and level ground that includes the state's largest city, Philadelphia. Immediately to the northwest is the Piedmont Plateau, an area of farmland, low hills, and rolling plains. This area covers most of southeastern Pennsylvania.

To the immediate northeast of the Piedmont, there is a narrow finger-shaped region extending out of New Jersey called the New England Upland. The industrial cities of Allentown, Bethlehem, and Easton are found in this area of low rolling hills and forests. At the southwestern part of the Piedmont, coming out of Maryland, is another narrow region called the Blue Ridge. The Blue Ridge province is hilly and has many productive farms, orchards, and dairies.

The Appalachian Ridge and Valley physiographic region is in the center of Pennsylvania and covers about half of the state, crossing from Maryland and into New Jersey. It is part of the Appalachian Mountains and includes the highest point in Pennsylvania, Mt. Davis at 3,212 ft (979 m). To the west and north is the Allegheny or Appalachian Plateau. This area consists of valleys and divides and covers the majority of western and northern Pennsylvania. Pittsburgh, the state's second largest city, is located here, as well as Allegheny National Forest. The region also once had very productive coal and natural gas mines.

Finally, on the northwest tip of the Pennsylvania panhandle is the Erie Lowland. Found on Lake Erie, the area is flat, has significant vegetable and fruit production, and also includes the city of Erie, a major shipping port for transport through the Great Lakes and the St. Lawrence Seaway.

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## Persepolis

ONE OF THE MOST magnificent cities of the ancient world, Persepolis was the political, cultural, and religious center of the Achaemenian PERSIAN EMPIRE for over 200 years before its complete destruction at the hands of Alexander the Great in 330 B.C.E.

The ruins of Persepolis lie at the foot of Kuh-i-Rahmat, the "Mountain of Mercy," in the plain of Marv Dasht about 400 mi (650 km) south of the present capital of IRAN, TEHRAN. The site is remote, in a large barren plain surrounded by sharp cliffs, and the ruined city lay hidden for over a thousand years before it was identified in 1620. It was occasionally visited by the curious, but it was not until the 1930s that a scientifically planned expedition was sent to excavate and systematically map and catalog the ruins.

The Persepolis Expedition was sponsored by the University of Chicago's Oriental Institute, later joined by the University Museum in Philadelphia and the Boston Museum of Fine Arts. Its leaders were Ernst Herzfeld and Erich Schmidt, and the project employed up to 500 men recruited from local villages: diggers, draftsmen, recorders, mechanics, and others. World War II put an end to this project, which was taken up again after the war by the Iranian Antiquity Service and the Italian Institute of the Middle and Far East in Rome.

Persepolis was founded sometime in the reign of Darius I, probably around 518 or 516 B.C.E. Inscriptions show that he imagined the city to be a magnificent showpiece for the mighty new empire he and his predecessors, Cyrus and Cambyses, had created. It was called Parsa, City of the Parsis ("Persepolis" in Greek); it is known today in Iranian as Takht-e-Jamshid, "the Throne of Jamshid," a mythical king of Persia. The Achaemenid kings made it an administrative center as well as a stage for receptions and ceremonial festivities. Wealth from all corners of the empire was featured in its decoration to showcase the immensity and diversity of the empire. Darius did not live long enough to finish

his project. In fact, most of Persepolis was built by his son, Xerxes. Still, the complex was not entirely completed until the reign of Artaxerxes I, about 100 years later.

The main feature of the city was the palace complex, a large terrace, about 990 by 1,485 ft (300 by 450 m), rising 33 to 66 ft (10 to 20 m) above the surrounding ground. On this terrace were built the main ceremonial buildings: the Apadana, the Throne Hall, the Gate of Xerxes, the palaces of Darius and Xerxes, the Harem, the Treasury, and the Council Hall. The Audience Hall of the Apadana is the largest and most splendid of these buildings, with 72 columns (of which 13 still stand), two monumental stairways, and rows of reliefs with representations of the 23 subject nations of the empire—each bearing tribute gifts—followed by Persian and Median court notables, soldiers, horses, and royal chariots. A short distance from the city, other grandiose buildings were built to house the tombs of the Achaemenid kings, similar to the Valley of the Kings in EGYPT.

Persepolis was renowned for its beauty and splendor, but because it was such a strong symbol of Persian power and glory, it was an obvious target for Alexander the Great. Alexander's destruction of the city was thus highly symbolic of his complete victory over the Persians. According to Plutarch, Alexander's men burned the entire complex to the ground and carried away its treasures on 20,000 mules and 5,000 camels.

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## Persian Empire

THE PERSIAN EMPIRE was one of the first of the world empires to emerge in the ancient Middle East, the first to unify several different peoples and cultures into one large heterogeneous state. Much of this work was achieved by the emperors Cyrus and Darius, who recognized the strength of diversity, picking the best of a variety of practices and customs and welding them into a system that worked best for the empire as a

whole. The original Persian Empire endured only two centuries, but it set a standard to be emulated by successive large multinational states set up by the Greeks and the Romans for centuries to come.

The name *Persia* comes from a specific province within the empire, in what is today southwestern IRAN. Here, in Pars (or Fars), the people spoke a language related to other peoples in INDIA and Europe, but different from the Semitic peoples of Mesopotamia to the west. The Persian tribes (or Parsis) lived in the hilly region between the great empires of the Medes to the east and the Babylonians to the west and were ruled by each of them at various times. Parsis were descended from tribes known as Aryans, which eventually gave its name to modern Iran.

In about 559 B.C.E., a Persian leader, Cyrus, unified the tribes, and led a revolution that overthrew the Medes and took over all of their territory (most of modern-day Iran). Cyrus the Great (559–530) established the first major Persian dynasty, the Achaemenid Dynasty, and took the title shah, or king. Instead of oppressing their former rulers, the Persian rulers united the Parsis and the Medes into one people, incorporating the Medes's strong central government rather than trying to re-create it from scratch. By 539, the combined armies of Persians and Medes had conquered not only neighboring Babylon, but parts of Asia Minor (Anatolia) and Central Asia as well.

### CONTINUED EXPANSION

The empire continued to expand under Cyrus the Great's son, Cambyses (530–522 B.C.E.), who conquered Egypt, and his distant cousin, Darius I (522–486), who led his armies as far as the Indus valley in the east and GREECE in the west. Darius was stopped by the Greeks famously after the Battle of Marathon in 490, but his legacy is concerned more with the brilliance of his skills as an administrator of an empire. He organized the empire into a series of regional governments, or satrapies, ruled by men loyal to the emperor alone, responsible for collecting taxes and organizing local militias.

Darius also created public works—irrigation, canals, and public buildings—and built good roads for the improved communication and trade between parts of the empire. He created one single currency and a postal system, and standardized weights and measurements to be used throughout the empire. Darius also built a new capital, on plans laid down by his predecessor, Cyrus, at PERSEPOLIS, one of the largest collections of palaces and buildings the world had ever seen.



*The original Persian Empire endured only two centuries, but it set a standard to be emulated by successive large multinational states set up by the Greeks and the Romans for centuries to come.*

Persia at this time became a center for learning, collecting, and synthesizing the technological and intellectual advances of its many subject peoples, including mathematics from India, irrigation from Mesopotamia, and ship-building from the Greeks. Amidst this cultural flowering, a distinctively Persian religion emerged, one of the first world religions centered on one god instead of many.

The teachings of the religious prophet Zoroaster (c. 628–551 B.C.E.) focused on the two fundamental aspects of a supreme being, the aspect of light, truth, health and goodness (Ahura Mazda) and the aspect of darkness, sickness and evil (Ahriman), which eternally strove together for dominance in the universe. Unlike the religions of Babylon and EGYPT, Zoroastrian leaders, known as Magi, taught that there was life after death (for everyone, not just kings) and provided hope for the ultimate victory of Ahura Mazda.

The Achaemenid Persian Empire was the largest and most powerful empire the world had thus far seen,

affecting nearly every Eurasian civilization except CHINA. Its greatest impact was in the sharing of intellectual and technological advances from societies as geographically far apart as Egypt and the Indus Valley. But ultimately the size of the empire was too much for one single ruler to handle. The son of Darius the Great, Xerxes, renewed his father's attempts to subdue the Greeks and was again pushed back at Salamis in 480 B.C.E. His defeat in the west encouraged rebellions among the tribes of the east. Political weakness grew through internal and dynastic struggles, inviting Greek armies led by the young King of Macedonia, Alexander the Great, to invade in 334 B.C.E. Within only eight years, Alexander brought the mightiest world empire to its knees and had incorporated it into a new, Hellenic (or Greek) empire. The last emperor, Darius III, was defeated at Gaugamela and killed in 331, and his capital at Persepolis was burned to the ground.

For the next three centuries, the main language of imperial rule and culture would be Greek, but the em-



pires of Alexander and his successors did learn a great deal from the Persians about respecting the individuality of their subject peoples, and incorporating and adapting their diverse cultures to benefit the whole. This practice was in turn adopted by the Romans after the first century, and again by the Islamic caliphates established over much of the same area in the 6th century C.E. The territories of the ancient Persian Empire went through many successive rebirths, as the empires of the Parthians, Sassanians, and Safavids rose and fell. The last imperial dynasties, the Qajars and Pahlavis, witnessed the final decay of the Persian Empire across the 19th and 20th centuries, controlled by European and American powers until the Islamic Revolution of 1979 established the theocratic state of Iran.

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## Persian Gulf

THE COUNTRIES BOUNDING the Persian Gulf include OMAN, UNITED ARAB EMIRATES, QATAR (a peninsula off the SAUDI ARABIA coast), BAHRAIN (an island), Saudi Arabia, KUWAIT, IRAQ, and in the north, IRAN. The Persian Gulf is an arm of the ARABIAN SEA extending some 600 mi (970 km) from east to west. It covers an area of approximately 89,000 square mi (230,000 square km) and the greatest depth is 335 ft (102 m). It is connected to the Arabian Sea in the east by the Strait of Hormuz. Its southern coastal area is characterized by low desert plains. The western coast continues as desert plains with a coastal escarpment that leads into a major river delta known as the Shatt al-Arab. The northern coast is more rugged but equally desert. The ancient Greeks named the gulf as "Persian" and so it has appeared in sources from antiquity and is in common use until today. Some Arab states and authors sponsor a modern revision to the "Arab Gulf."

The Persian Gulf has acted as a route for trade since the earliest millennia of human civilization. From 4000 B.C.E. onward, increasing complex trading relationships are supported by archaeological evidence.

Trading centers such as Dilham (most likely modern Bahrain) and Madgan (Oman) linked Mesopotamia to the Indus Valley in South Asia. As the dynasties of history grew greater, the more elaborate the trade links. Intervening cities and ports flourished as suppliers and middlemen along this flow of metals, wood, spices, incense, and finished goods. The Persian Gulf proved to be perfect for this gradual growth of trade and enabling technologies. The simplest boats could move down these feeding rivers to the salty shores of the gulf and sea and make their way along coastlines to their partners in trade and commerce.

The domestication of camels led to the expansion of land routes of commerce that enhanced the Persian Gulf trade. Shipbuilding technologies improved and the discovery of the monsoons for seasonal travel to and from India modified routes and trade links. A Persian Gulf coast culture based upon cities of commerce developed and prospered.

The settled people of the Persian Gulf coast differed from the nomadic peoples of the interior of the Arabian Peninsula and the lands along the northern coast of the gulf. The nomads were children of the deserts, and the coastal peoples were dependent upon the sea. One moved across endless deserts to points of water that gave life to their flocks. The other settled on the shores of the endless waters to capture the largess that made their livelihood. If the deserts could not feed their flocks, the nomadic tribes pushed into the settled towns of agriculture and trade.

Cycles of tribal incursion onto the coastal settlements blended Arab culture with that from Mesopotamia and the lands of INDIA, continuing to build a unique Persian Gulf character. Also, these settlements and the tribes that plied the Persian Gulf began to take on an increasingly Arab flavor because of the consistent out migration from the Arab interior. Some Arab tribes from the rocky wastes and scattered oases of the peninsula came to the coasts and adopted the less mobile life of the settlement. Other tribesmen, masters of the sand, became masters of the sea. They took up sailing and began to build the legend of Arab traders and pirates.

In 325 B.C.E., Alexander the Great sent fleets of ships from India to explore the shores and islands of the Persian Gulf. Greek influence was not able to take permanent hold; by 250 B.C.E. the Parthians had brought the gulf under predominantly Persian control for the first time. This control of the Persian Gulf from a northern empire would last until the coming of ISLAM. Islam spread to the gulf during the life of the Prophet

Muhammad and soon reached to all peoples on its shores. The prosperity of the Persian Gulf continued as in 750 C.E. Baghdad became the seat of the caliph and the main center of Islamic civilization and power.

Oman was positioned geographically to take advantage of sea routes in the Persian Gulf and to the RED SEA. The lands around the mouth of the Persian Gulf became the stronghold of those seeking to challenge the powers that controlled the Persian Gulf trade from along the Tigris and Euphrates. Thus began a dance of influence in the Persian Gulf as powers in Mesopotamia vied with those in Muscat. This foretold the long history of conflict between those in the Persian Gulf against outside powers who sought to control this strategic body of water because of the wealth it could command.

By the year 1000, Persian Gulf merchants were traveling regularly to Southeast Asia and beyond to CHINA. Their trading efforts were instrumental in spreading Islam, first to India and then to INDONESIA and MALAYSIA. The tribes of the interior remained culturally distinct from the gulf coastal peoples even under Islam. Empires based in Persian and Iraq depended on customs duties from the East-West trade in the Gulf. Those Arabs along the coasts always had to deal with these external factors. This reality led to political compromises and some cultural concessions. Those in the interior often remained more conservative and traditional. The coastal cities and accompanying wealth of trade passed through the hands of many Islamic rulers over the years be they from Mesopotamia, Persia, or Arabia.

### EUROPEAN INTERESTS

European influence in the Persian Gulf dawned with the Portuguese invasion of Oman in 1502. Lasting for only a century, it heralded the coming contentions of colonial powers in the Persian Gulf. Britain gradually took lead as it established protectorates of the Persian Gulf emirates in the 19th century. With the discovery and exploitation of the vast oil potential of the Persian Gulf in the 20th century, the interests of the industrialized world were inextricably tied to these ancient waters of political and economic power. Britain relinquished its role as protector of Persian Gulf commerce to the UNITED STATES soon after World War II.

The United States played a limited part until Iraq invaded Iran in 1980 and the ensuing war threatened the safe passage of oil tankers out of the Persian Gulf. As the land conflict between Iraq and Iran became a stalemate, both sides increasingly moved their attacks

into the Persian Gulf. In March 1984, Iraq initiated sustained naval operations in its self-declared maritime exclusion zone that extended from the mouth of the Shatt al Arab to Iran's port of Bushehr. Since the beginning of its invasion of Iran, Iraq had attacked Iranian oil infrastructure as well as neutral tankers and ships trading with Iran.

Iraq expanded the "tanker war" in 1984 by using its French-supplied combat aircraft armed with sophisticated guided missiles. Unprotected neutral merchant ships became favorite targets, and with the very capable Western war technologies, attacks moved farther and farther south. Seventy-one merchant ships were attacked in 1984 alone, compared with 48 in the first three years of the war. Repeated Iraqi attacks on Iran's main oil-exporting terminal at Khark Island failed to stop oil exports but added to the mounting petroleum releases into the Persian Gulf. Iran retaliated by attacking first a Kuwaiti oil tanker near Bahrain and then a Saudi tanker in Saudi waters, making it clear that if Iraq continued to interfere with Iran's shipping, no gulf state would be safe. The entire Persian Gulf was embroiled in the war and awash with the flotsam and jetsam of a focused battle against oil production and export.

Saudi Arabia shot down an Iranian Phantom jet over Saudi territorial waters in 1984, but there was no concerted effort to stop the attacks on shipping. Iraq increased its air raids on tankers that were serving Iran and Iranian oil-exporting facilities in 1986 and 1987. They even began attacking vessels that belonged to the conservative Arab states of the Persian Gulf. Iran responded by escalating its attacks on shipping serving Arab ports in the Gulf. Kuwait became a focus of Iran's attacks. The Kuwaiti government sought protection from the international community in the fall of 1986. The Soviet Union responded first, agreeing to charter several Soviet tankers to Kuwait in early 1987. Washington, which has been approached first by Kuwait and which had postponed its decision, eventually followed Moscow's lead.

On May 17, 1987, Iraqi aircraft launched a missile attack on the USS *Stark*, killing 37 crew members and crippling the ship. Baghdad issued official apologies and the U.S. chose to blame Iran for escalating the war and launched a full-scale naval campaign to escort Kuwaiti tankers that were "reflagged" as American vessels and manned by American crews. Iranian small boat attacks and mine-laying operations caused damage to U.S. protected shipping. The U.S. navy retaliated by destroying Iranian offshore oil platforms.

The U.S. naval forces skirmished with Iranian forces and limited their ability to interdict Iraqi supplies and equipment arriving through ports in Kuwait. The USS *Vincennes*, a missile cruiser, mistook an Iranian commercial airliner as a combatant and shot it down, killing 290 civilians. The Persian Gulf had become a crowded theater of operations with at least ten Western navies and eight regional navies patrolling the area. Merchant ships continued to be damaged and the shipyards along the Arabian coast were operating at full capacity effecting repairs.

The Western nations generally favored Iraq in the conflict, providing military intelligence and selling large amounts of military arms. Both sides attacked civilian targets with missiles and aircraft, increasing the level of casualties and destruction. Iraq used chemical warfare against Iranian military forces. The war ground to a bloody stalemate and both sides agreed to a UN-sponsored cease-fire in 1988.

In 1990, Iraq chose Kuwait as a target for invasion and annexation. Iraq made several spurious claims about Kuwait regarding oil and finances. Rhetoric about illegally pumping oil from under their border, violating production quotas to drive down prices, and not forgiving previous debts were all proffered as complaints against Kuwait. Other Arab states were assisting with mediation when Iraq invaded on August 2, 1990. A U.S. lead military coalition flooded to the Persian Gulf lodging in Saudi Arabia. In 1991 the UN-sponsored military coalition defeated the Iraqi army and liberated Kuwait on February 28. U.S.-led coalition forces enforced continuing UN sanctions against Iraq by military attacks and maritime interdiction for a decade.

In 2003, U.S. and British forces invaded Iraq from Kuwait. U.S.-led coalition naval forces continue to operate to ensure the free flow of commerce and security along the shipping lanes in the gulf. The Iraqi navy is operating once again in the Persian Gulf. The United States and other Western powers have shown that they will act against any new instability in the gulf that endangers their national interests.

## PETROLEUM

In 2002, the Persian Gulf countries (Bahrain, Iran, Iraq, Kuwait, Qatar, Saudi Arabia, and the United Arab Emirates) produced about 25 percent of the world's oil. These countries hold almost 65 percent of the world's proven crude oil reserves. The Persian Gulf region also has some 36 percent of total proven world gas reserves. Another significant factor to world indus-

trial interests is that the Persian Gulf countries maintained about 32 percent of the world total oil production capacity. Most strikingly, the Persian Gulf countries normally maintain around 90 percent of the world's excess oil production capacity. Excess production capacity is important in the event of oil supply disruption in other major oil-producing regions or unexpected depletion of stocks.

With the advent of oil exploration, boundary and territory disputes abounded in the gulf. Most have been resolved and the trend is favorable, as all parties look to increased revenues that only peaceful resolution can bring. The flow of oil from the Persian Gulf continues to be primarily by tanker. In 2002, some 88 percent of oil exported from the Persian Gulf transited by tanker through the Strait of Hormuz. Almost 40 percent of all the oil produced for export and trade in the world passes through this CHOKE POINT. JAPAN receives over 75 percent of its crude oil from the Persian Gulf.

## POLLUTION

The primary factor in pollution of the Persian Gulf is the massive extraction and transport of oil and associated petroleum products. There is a continuous discharge of petroleum effluents from offshore wellheads, underwater pipelines, loading terminals, and runoff from onshore facilities. Estimates of amounts are difficult to gather, but enforceable standards and controls are limited or nonexistent in most national jurisdictions.

The movement of 40 percent of the world's total oil trade through these waters creates shipping-associated discharges of marine diesel fuel, waste, and, of most concern, millions of gallons of contaminated ballast water. The oil sludge, released by the aggregate of tankers traversing the Persian Gulf, is estimated to be around 8 million metric tons per year. The sea bed along the primary routes to the regional oil terminals is often covered with oil sludge. No enforceable international requirements exist to address this daily pollution by oil tankers.

The circulation parameters of the waters in the Persian Gulf along with a high rate of water evaporation as opposed to its fresh water supply add to pollution management challenges. The coastal zone, with its intertidal mudflats and near-shore islands, is important for breeding sea birds and other migrating species. The extensive coral reefs and coastal mangrove forests are especially susceptible to damage and destruction caused by petroleum pollution. The long-term effects

on commercial fishing stocks have yet to be determined.

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## Peru

**Map Page** 1139 **Area** 496,226 square mi (1,285,220 square km) **Population** 27,148,000 **Capital** Lima **Highest Point** 22,205 ft (6,768 m) **Lowest Point** 0 m **GDP per capita** \$2,126 **Primary Natural Resources** copper, silver, gold, petroleum, timber, fish, iron.



PERU IS A country of contrasts. The fourth-largest country in Latin America, Peru has an amazing geography, a rich and long history, a diverse population, and enormous natural resources. Its geography and environment have shaped Peru's history. Its few rivers, poor and dispersed soils, and extreme altitudes have presented enormous challenges and difficulties to its inhabitants. Peru has three distinctive geographical areas: the Pacific coast, the Andean region, and the Amazon basin.

The Pacific coast has been the focus of Peru's modern political and economic life. The Pacific coast was also the home of the first civilizations in the area, such as the Moche, Nazca, and Chimu cultures. In January 1535, the Spanish conquerors founded the capital city—the City of the Kings, or Lima—on the coast far away from the Inca center of power located in the ANDES. Today, Lima has about 8 million people and is the largest city in the country. A permanent migration

from the countryside has created acute social and urban problems in Lima, as most internal migrants have been poor and have settled in shantytowns located in the periphery of the city called Pueblos Jóvenes (young towns).

The first export-oriented economic activity developed along the Pacific coast was the guano industry. Extracted from small islands located along the Peruvian central coast, guano, or dried excrement of seabirds, was exported as a fertilizer to countries such as England, FRANCE, AUSTRALIA, and the southern UNITED STATES as a fertilizer. Between 1845 and 1880, Peru exported 11 million tons of guano. The guano boom was followed by an agricultural boom. In the north coast region, sugar production grew steadily between the 1880s and the 1930s, and although production stagnated in the following decades, it has remained a relatively important economic activity for the country.

Cotton also became an important commodity in the late 19th century, and especially after World War I. In the second half of the 20th century, the fishing industry became one of the fastest-growing economic activities in the country. By the late 1960s, Peru was exporting 12 million tons of anchovetas, and the port of Chimbote became a growing economic and urban center.

The Andean region includes a wide range of climates and microenvironments and has been an important source of mining and agricultural products and livestock. The Puna, the territory located at about 4,000 ft (1,291 m) of altitude, has rich and green grasslands and abundant livestock such as llamas, alpacas, and vicuñas. The lower valleys have been historically devoted to agriculture and have been the home of traditional peasant and Indian communities. The products changed according to the altitude. Products such as wheat, barely, quinoa, and rye can be cultivated at a relatively high altitude; at lower levels, peasants have grown maize, alfalfa, and other vegetables.

Toward the south, the Puna ends in the ALTIPLANO or high plateau, where conditions for agriculture and human settling are extremely difficult. Despite the environmental limitations, in pre-Columbian times, Andean cultures were able to domesticate the potatoes, growing about 200 types of potatoes on the eve of the Spanish conquest. The Andes also has rich mining resources such as copper and silver. The Andean region was also the center of the Inca Empire. From the city of Cuzco, the Incas dominated the Andes until the Spanish conquest in the 1530s.



The jungle region has two distinctive areas: the *montaña*, or eastern slope of the Andes and the lower and flat jungle. The jungle area started growing as a result of the rubber boom in the late 19th century. Throughout the 20th century, the jungle has been important for its production of coca leaves and, lately, the development of a tropical agriculture that includes products such as coffee, sugar, and fruit for the national market.

The population of Peru is diverse. As in other Andean countries, Peruvian society is divided along ethnic-social lines that have their origin in its history of conquest and conflict. The three major groups are Indians, *mestizos*, and whites. Peru has also influential immigrant communities such as Afro-Peruvians, Japanese, who started migrating at the beginning of the 20th century, and Chinese, who migrated to work in the guano and railroad industries in the mid-19th century.

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## Petra

PETRA HAS BEEN described in *National Geographic* magazine as being “JORDAN’s city in the rock.” There is no doubt, however, that Petra, located south of Amman on a semiarid site at the edge of the Wadi Araba mountainous desert, is a wonder of the ancient world. Originally developed at the crossroads of overland trading routes, Petra developed as the capital of the Nabatean Empire (c. 400 B.C.E. to 106 C.E.).

Utilizing the local sandstone rock faces—the colors of which vary from white to cream to red and brown—the Nabateans carved tombs and temples into the rocky outcrops. Using their knowledge of hydraulic engineering the Nabateans cut water channels and tunnels into the rock so as to bring drinking water into the developing city from a local dam.

Entering Petra via a narrow channel (the Siq) between two large rock faces, the walkway leads directly to one of the city’s most important former edifices, the

131-ft- (40-m-) high Khazneh (treasury), the front of which is dominated by a huge Roman portico. Despite the remarkable exterior, the Khazneh’s interior contrasts greatly and is simply formed.

The old heart of Petra lies on open ground around an area known as Wadi Musa. A Roman roadway from the Khazneh leads to the area and is lined with impressive columns. The Roman legacy can be further seen by the layout of a marketplace and amphitheater. However, other prominent structures include the gateway of the temenos and temples such as Qasr-al Bint Firaun (the Castle of the Pharaoh’s Daughter) and the Temple of the Winged Lions.

Annexed by the Romans in 106 C.E., Petra slowly declined as a commercial center in the following centuries. The arrival of the Byzantines in the 4th century did not greatly change the fortunes of the settlement, partly because of earthquakes and an economic lull. Thus, at the end of the Byzantine Empire (circa 700 C.E.), Petra was in a poor condition, buildings were in near ruin, and the incredible dignity of the city established under the Nabateans was all but lost. In the following centuries, the name of Petra was maintained in local folklore but lost to the West until 1812 when a Swiss explorer, Johann Burchhardt, discovered the ancient settlement. Today, to protect the remaining city, the Jordanian government has moved the local Bedouin population to houses away from the historic core.

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## Philippines

**Map Page** 1124 **Area** 115,831 square mi (300,000 square km) **Population** 84,619,974 **Capital** Manila **Highest Point** 9,691 ft (2,954 m) **Lowest Point** 0 m **GDP per capita** \$912 **Primary Natural Resources** timber, petroleum, nickel, cobalt, gold.



OFF THE SOUTHEAST COAST of mainland Asia lies the Philippines, a southeast Asian country that consists of an archipelago in which there are over 7,100 islands and islets. Most of these islands are of volcanic origin. The latest massive volcanic eruption of Mt. Pinatubo in 1991 caused about 600 deaths, as well as flooding and mudflows.

The north-south extent of the country is 16 degrees of latitude. The two largest islands are LUZON in the north and MINDANAO in the south. They are separated by about 200 mi (322 km). In its tropical marine type of climate regime, temperature varies from 75 degrees F (30.8 degrees C) to 87 degrees F (35.7 degrees C). Average rainfall is 120 in (304 cm), with distinct regional variations. Dry areas are in northern Luzon, Cebu, southern Negros, and interior Mindanao, Sulu and Palawan islands.

Historically, the Philippines was first inhabited by pygmy-like Negroids, followed by Mongoloids and Caucasian groups starting around 11,000 years ago. The largest migration wave was of the Malays (lowland Filipinos) starting from 300 B.C.E. After explorer Ferdinand MAGELLAN's visit in 1521, Spanish colonization in the form of settlements began in 1565. The settlement of MANILA dates back to 1671. Spaniards successfully converted the natives to Catholicism.

The UNITED STATES became the master of the Philippines in 1898 as a result of the Treaty of Paris. Japanese occupation during World War II of the Philippines (1941–45) was brutal, but soon after U.S. reoccupation in 1945, the country became independent in 1946. A democratic form of government was introduced and elections took place every four years. Ferdinand Marcos, first elected president in 1965, put an end to democracy in 1972 and declared martial law in the name of upholding law and order. Democracy came back to the country in 1986 after Marcos was removed from power and a new constitution was adopted. Elections occurred every six years since then. Political instability, combined with Muslim fundamentalist rebellion in Mindanao, which has been recently infested with al Qaeda influence, accentuates centrifugal (disintegrating) forces within the country.

Economic growth since the 1970s has been erratic and lurching. Gross domestic product growth rate in 2002 was 4.6 percent. Forty percent of the country's population lives below the poverty line. Of the total labor force, 40 percent are engaged in agriculture, 27 percent in services, and a mere 10 percent in manufacturing. Rice is the principal crop, followed by corn, sugar, and copra. Industries include pharmaceuticals,

food processing, electronic assembly, petroleum refineries, textiles, and wood products.

The Philippines is a Catholic country, a legacy of Spanish colonization; 83 percent of the population is Roman Catholic; 9 percent is Protestant, and 5 percent is Muslims, mostly on Mindanao. Because of strong religious beliefs held by Catholics and Muslims, family planning methods are resisted, which leads to a high fertility rate of 3.29 children born per reproductive-age woman (2003). The two official languages are Filipino and English.

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## Phoenicia

ANCIENT PHOENICIA, A LOOSE confederation of city-states existing between 3000 B.C.E. and 146 B.C.E., was located where LEBANON is now. The culture was known for seafaring commerce and trade, and colonizing. The most important legacy left by the Phoenicians, though, was a 22-character alphabet that became the basis of Hebrew, Greek, and Roman script. In 1600 B.C.E., an alphabet called proto-Canaanite was used in the east Mediterranean area. Proto-Canaanite consisted of 28 symbols standing for syllables and was based on Egyptian hieroglyphics. Over a few centuries, the Phoenicians developed their own alphabet from this. Because of their widespread trade, the Phoenicians were in a position to spread the writing they used all over the Mediterranean region. The Greeks adapted the alphabet in the 8th century B.C.E. and added vowel sounds and characters to indicate individual sounds, rather than syllables. This version spread to the Balkans, RUSSIA, and ITALY.

The Phoenicians had arrived in the Levant around 3000 B.C.E.; their original homeland is not known. They settled between the MEDITERRANEAN SEA and the mountains of LEBANON on a narrow strip of land. What

they called themselves is not known; some inscriptions dating back to the 15th century B.C.E. refer to them as Canaanites. Initially, their major city was Sidon, and they were also called Sidonites in the Old Testament of the Bible. By 1200 B.C.E., the Phoenicians had built major port cities along the Mediterranean. Tyre soon surpassed Sidon in influence; other cities were Byblos, Akka, Aradus, and later, Berytus. These port cities were governed as independent city-states and ruled by hereditary kings.

The Phoenicians exploited all available resources in their homeland, including the rich forests. It was as traders, however, that they were best known. They harvested and shipped the cedars, pines, and cypresses of the Lebanon forests. Other products included textiles; Phoenicians became noted for the rich purple color of their cloth, which came from the snail in murex shells. Small hills of these discarded shells, several meters high, have been found while excavating ancient Sidon. Phoenicians were also known for their glassware, which was often clear; they may have invented glass-blowing. Phoenicians may also have trafficked in slaves. Metal working became a Phoenician art. The metals came from as far away as Britain, IRELAND, SPAIN, and Brittany; the raw materials were imported through the network of colonies Phoenicians had established throughout the Mediterranean region.

Phoenician colonies, like their home cities, were often built on rocky promontories and islets with a view over harbors in highly defensible positions. The earliest Phoenician colony was Kition, on CYPRUS, a source of copper. In 1110 B.C.E., the Phoenicians founded Gades (Cádiz). Utica, in North Africa, was built in 1101. Malaca (Málaga), Joppa (Yafo), Leptis Magna (near present-day Tripoli), and many other cities along the coasts of North Africa, southern Iberia, and the islands of the Mediterranean followed. By the 8th century, Phoenicians were trading beyond the Mediterranean, along the Atlantic coasts of Spain and MOROCCO, especially for metals such as copper, tin, and gold. In 814 B.C.E. they founded their most important colony, Carthage, near what is now Tunis. Herodotus claimed that the Phoenicians circumnavigated Africa, which took three years.

By 875 B.C.E., most—but not all—of the cities in Phoenicia were paying tribute to the Assyrian Empire, and within 150 years Phoenicia was annexed to that empire. The Assyrian Empire fell in 612 B.C.E., and in 539 B.C.E. Phoenicia became part of the PERSIAN EMPIRE. Phoenician colonies continued to trade and dominate the Mediterranean, governing themselves auton-

mously under the leadership of Carthage. Carthage controlled trade from the Straits of Gibraltar, founded its own colonies in southern Spain, and continued to trade in metals as the original Phoenician cities had done. The area around Carthage produced rich harvests of grain, and the city controlled the export and sale of that as well. Carthage engaged in long-standing rivalry with Greek trading colonies such as Massalia (Marseilles).

The strong navy of Carthage dominated the Mediterranean until 241 B.C.E., when Rome, having consolidated power in Italy, wrested control of Sicily from Carthage in the First Punic War. During the Second Punic War in 218 B.C.E., the Carthaginian general, Hannibal, crossed the Alps into Italy with his army and elephants and defeated the Romans. But in 202 B.C.E., the Roman general Scipio Africanus beat Hannibal at Zama, and forced the Carthaginians to give up their control of Spain, limit their fleet, and pay heavy taxes. Over the years, Carthage began to return to strength, and in 146 B.C.E., Rome went to war with the city again. After a six-month siege, Rome completely destroyed the city, killed or enslaved all the inhabitants, and sowed the surrounding fields with salt so that nothing would grow there again.

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## physical geography

PHYSICAL GEOGRAPHY IS AN integral part of a much larger area of understanding called geography. Most individuals define geography as a field of study that deals with maps. This definition is only partially correct. A better definition of geography may be the study of natural and human phenomena relative to a spatial dimension. The discipline of geography has a history that stretches over many centuries. Over this time period, the study of geography has evolved and developed into an important form of human scholar-

ship. Examining the historical evolution of geography as a discipline provides some important insights concerning its character and methodology. These insights are also helpful in gaining a better understanding of the nature of physical geography.

Physical geography, a subdiscipline of geography, is a field of knowledge that studies natural features and phenomena on the Earth from a spatial perspective. It primarily focuses on the spatial patterns of weather and climate, soils, vegetation, animals, water in all its forms, and landforms. Physical geography also examines the interrelationships of these phenomena to human activities. This subfield of geography is academically known as the Human-Land Tradition, and has seen very keen interest and growth in the last few decades because of the acceleration of human-induced environmental degradation. Thus, physical geography's scope is much broader than the simple spatial study of nature. It also involves the investigation of how humans are influencing nature. In other words, it focuses on geography as an Earth science, making use of biology to understand global flora and fauna pattern, and mathematics and physics to understand the motion of the Earth and its relationship with other bodies in the solar system. It also includes landscape ecology and environmental geography.

Thus, the discipline, in a sense, is better organized than its human or social counterpart because it rests upon specialist sciences like geology and meteorology which had made great progress. There is no dearth, but rather an embarrassing wealth, of material out of which to construct the subject.

## HISTORICAL OVERVIEW

Some of the first truly geographical studies occurred more than 4,000 years ago. The main purpose of these early investigations was to map features and places observed as explorers traveled to new lands. At this time, Chinese, Egyptian, and Phoenician civilizations were beginning to explore the places and spaces within and outside their homelands. The earliest evidence of such explorations comes from the archaeological discovery of a Babylonian clay tablet map that dates back to 2300 B.C.E.

The early Greeks were the first civilization to practice a form of geography that was more than mere mapmaking or cartography. Greek philosophers and scientists were also interested in learning about spatial nature of human and physical features found on the Earth. One of the first Greek geographers was Herodotus (circa 484–425 B.C.E.). Herodotus wrote a

number of volumes that described the human and physical geography of the various regions of the PERSIAN EMPIRE.

The ancient Greeks were also interested in the form, size, and geometry of the Earth. Aristotle (c. 384–322 B.C.E.) hypothesized and scientifically demonstrated that the Earth had a spherical shape. Evidence for this idea came from observations of lunar eclipses. Lunar eclipses occur when the Earth casts its circular shadow on to the moon's surface. The first individual to accurately calculate the circumference of the Earth was the Greek geographer Eratosthenes (c. 276–194 B.C.E.). Eratosthenes calculated the equatorial circumference to be 25,000 mi (40,233 km) using simple geometric relationships. This primitive calculation was unusually accurate. Measurements of the Earth using modern satellite technology have computed the circumference to be 24,899.5 mi (40,072 km).

Most of the Greek accomplishments in geography were passed on to the Romans. Roman military commanders and administrators used this information to guide the expansion of their empire. The Romans also made several important additions to geographical knowledge. Strabo (circa 64 B.C.E.–20 C.E.) wrote a 17-volume series called *Geographia*. Strabo claimed to have traveled widely and recorded what he had seen and experienced from a geographical perspective. In his series of books, Strabo describes the cultural geographies of the various societies of people found from Britain to as far east as INDIA, and south to ETHIOPIA and as far north as ICELAND. He also suggested a definition of geography that is quite complementary to the way many human geographers define their discipline today. This definition suggests that the aim of geography was to describe the known parts of the inhabited world and to write the assessment of the countries of the world with clearly highlighting the differences between countries.

During the 2nd century C.E., PTOLEMY (c. 100–178) made a number of important contributions to geography. Ptolemy's publication, *Geographike hyphegesis* (*Guide to Geography*), compiled and summarized much of the Greek and Roman geographic information accumulated at that time. Some of his other important contributions include the creation of three different methods for projecting the Earth's surface on a map, the calculation of coordinate locations for some 8,000 places on the Earth, and development of the concepts of geographical latitude and longitude.

Little academic progress in geography occurred after the Roman period. For the most part, the Middle



Ages (5th to 13th centuries) were a time of intellectual stagnation. In Europe, the Vikings of Scandinavia were the only group of people carrying out active exploration of new lands. In the Middle East, Arab academics began translating the works of Greek and Roman geographers starting in the 8th century and exploring southwestern Asia and Africa. Some of the important intellectuals in Arab geography were Al-Idrisi, IBN BATTUTA, and Ibn Khaldun. Al-Idrisi is best known for his skill at making maps and for his work of descriptive geography. Ibn Battuta and Ibn Khaldun are well known for writing about their extensive travels to North Africa and the MIDDLE EAST.

## RENAISSANCE

During the Renaissance (1400 to 1600), numerous journeys of geographical exploration were commissioned by a variety of nation-states in Europe. Most of these voyages were financed because of the potential commercial returns from resource exploitation. The voyages also provided an opportunity for scientific investigation and discovery and added many significant contributions to geographic knowledge. Important explorers of this period include Christopher Columbus, Vasco da Gama, Ferdinand MAGELLAN, Jacques Cartier, Sir Martin Frobisher, Sir Francis Drake, John and Sebastian Cabot, and John Davis. Also during the Renaissance, Martin Behaim created a spherical globe depicting the Earth in its true three-dimensional form in 1492. Prior to Behaim's invention, it was commonly believed in the Middle Ages that the Earth was flat. Behaim's globe probably influenced the beliefs of navigators and explorers of that time because it suggested that one could travel around the world.

In the 17th century, Bernhardus Varenius (1622–50) published an important geographic reference titled *Geographia generalis* (*General Geography*, 1650). During the 18th century, the German philosopher Immanuel Kant (1724–1804) proposed that human knowledge could be organized in three different ways. One way of organizing knowledge was to classify its facts according to the type of objects studied. Accordingly, zoology studies animals, botany examines plants, and geology involves the investigation of rocks. The second way one can study things is according to a temporal dimension. This field of knowledge is of course called history. The last method of organizing knowledge involves understanding facts relative to spatial relationships. This field of knowledge is commonly known as geography. Kant also divided geography into a number of subdisciplines. He recognized the following six branches:

physical, mathematical, moral, political, commercial, and theological geography.

Geographic knowledge saw strong growth in Europe and the UNITED STATES in the 1800s. This period also saw the emergence of a number of societies interested in geographic issues. In GERMANY, Alexander von HUMBOLDT, Karl Ritter, and Friedrich Ratzel made substantial contributions to human and physical geography. Humboldt's publication *Kosmos* (1844) examines the geology and physical geography of the Earth. This work is considered by many academics to be a milestone contribution to geographic scholarship.

Late in the 19th century, Ratzel theorized that the distribution and culture of the Earth's various human populations were strongly influenced by the natural environment. The French geographer Paul Vidal de la Blanche opposed this revolutionary idea. Instead, he suggested that human beings were a dominant force shaping the form of the environment. The idea that humans were modifying the physical environment was also prevalent in the United States. In 1847, George Perkins Marsh gave an address to the Agricultural Society of Rutland County, VERMONT. The subject of this speech was that human activity was having a destructive impact on land, especially through deforestation and land conversion. This speech also became the foundation for his book *Man and Nature or The Earth as Modified by Human Action*, first published in 1864. In this publication, Marsh warned of the ecological consequences of the continued development of the American frontier.

Many academics in the field of geography extended the various ideas presented in the previous century to studies of small regions all over the world. Most of these studies used descriptive field methods to test research questions. Starting in about 1950, geographic research experienced a shift in methodology. Geographers began adopting a more scientific approach that relied on quantitative techniques. The quantitative revolution was also associated with a change in the way in which geographers studied the Earth and its phenomena. Researchers now began investigating process rather than mere description of the event of interest. Today, the quantitative approach is becoming even more prevalent because of advances in computer and software technologies.

The history and development of geography, discussed above, suggest a definition that geography, in its simplest form, is the field of knowledge that is concerned with how phenomena are spatially organized. Physical geography attempts to determine why natural

phenomena have particular spatial patterns and orientation.

### ELEMENTS AND PHENOMENA

Physical geography and HUMAN GEOGRAPHY are the two major subfields of knowledge emanating from the discipline of geography. It is important to distinguish between these two subfields that use similar methodologies. Knowing what kinds of things are studied by geographers provides us with a better understanding of the differences between physical and human geography.

Phenomena or elements studied in physical geography include rocks and minerals, landforms, soils, animals, plants, water, atmosphere, rivers and other water bodies, environment, climate and weather, and oceans.

Phenomena or elements studied in human geography include population, settlements, economic activities, transportation, recreational activities, religion, political systems, social traditions, human migration, agricultural systems, and urban systems.

Geography is also a discipline that integrates a wide variety of subject matter. Almost any area of human knowledge can be examined from a spatial perspective. Also, the study of geography can involve a holistic synthesis, which connects knowledge from a variety of academic fields in both human and physical geography.

For example, the study of the enhancement of the Earth's greenhouse effect and the resulting global warming requires a multidisciplinary approach for complete understanding. The fields of climatology and meteorology are required to understand the physical effects of adding additional greenhouse gases to the atmosphere's radiation balance. The field of economic geography provides information on how various forms of human economic activity contribute to the emission of greenhouse gases through fossil fuel burning and land-use change. Combining the knowledge of both of these academic areas gives us a more comprehensive understanding of why serious environmental problems occur.

### STRENGTH AND WEAKNESS

The holistic nature of geography is a strength and weakness both. Geography's strength comes from its ability to connect functional interrelationships that are not normally noticed in narrowly defined fields of knowledge. The most obvious weakness associated with the geographical approach is related to the fact that holistic understanding is often too simple and misses important details of cause and effect.

Physical geography's primary subdisciplines study the Earth's atmosphere (meteorology and climatology), animal and plant life (biogeography), physical landscape (geomorphology), soils (pedology), and waters (hydrology). Some of the dominant areas of study in human geography include human society and culture (social and cultural geography), behavior (behavioral geography), economics (economic geography), politics (political geography), and urban systems (urban geography).

### SPECIALIZATION

Academics studying physical geography and other related earth sciences are rarely generalists. Most are in fact highly specialized in their fields of knowledge and tend to focus themselves in one of the following well defined areas of understanding in physical geography.

The fields of knowledge generally have a primary role in introductory textbooks dealing with physical geography. Introductory textbooks can also contain information from other related disciplines including geology—the study of the form of the Earth's surface and subsurface and the processes that create and modify it; ecology—the scientific study of the interactions between organisms and their environment; oceanography—the science that examines the biology, chemistry, physics, and geology of oceans; cartography—the technique of making maps; and astronomy—the science that examines nature, motion, origin, and constitution celestial bodies and the cosmos.

After 1950, the following two forces largely determined the nature of physical geography:

*The Quantitative Revolution.* Measurement became the central focus of research in physical geography. It was used primarily for hypothesis testing. With measurement came mapping, models, statistics, mathematics, and hypothesis testing. The quantitative revolution was also associated with a change in the way in which physical geographers studied the Earth and its phenomena. Researchers now began investigating process rather than mere description of the environment.

*The Study of Human/Land Relationships.* The influence of human activity on the environment was becoming very apparent after 1950. As a result, many researchers in physical geography began studying the influence of humans on the environment. Some of the dominant themes in these studies included environmental degradation and resource use; natural hazards and impact assessment; and the effect of urbanization and land-use change on natural environments.

## UNDERSTANDING PHYSICAL GEOGRAPHY

The nature of understanding in physical geography has changed over time. When investigating this change, it becomes apparent that certain universal ideas or forces had very important ramifications to the academic study of physical geography.

During the period from 1850 to 1950, there were five main ideas that had a strong influence on the discipline:

**Uniformitarianism.** This theory rejected the idea that catastrophic forces were responsible for the current conditions on the Earth. It suggested instead that continuing uniformity of existing processes were responsible for the present and past conditions of this planet.

**Evolution.** Charles Darwin's *Origin of Species* (1859) suggested that natural selection determined which individuals would pass on their genetic traits to future generations. As a result of this theory, evolutionary explanations for a variety of natural phenomena were postulated by scientists. The theories of uniformitarianism and evolution arose from a fundamental change in the way humans explained the universe and nature.

During the 16th, 17th, and 18th centuries, scholars began refuting belief- or myth-based explanations of the cosmos and instead used science to help explain the mysteries of nature. Belief-based explanations of the cosmos are made consistent with a larger framework of knowledge that focuses on some myth. However, theories based on science questioned the accuracy of these beliefs.

**Exploration and Survey.** Much of the world had not been explored before 1900. Thus, during this period all of the fields of physical geography were actively involved with basic data collection. This data collection included activities like determining the elevation of land surfaces, classification and description of landforms, the measurement of the volume of flow of rivers, measurement of phenomena associated with weather and climate, and the classification of soils, organisms, biological communities, and ecosystems.

**Conservation.** Beginning in the 1850s, a concern for the environment began to develop as a result of the human development of once natural areas in the United States and Europe. One of the earliest statements of these ideas came from George Perkins Marsh (1864) in his book *Man in Nature or Physical Geography as Modified by Human Action*. This book is often cited by scholars as the first significant academic contribution to conservation and environmentalism.

**Systems Theory.** The world of nature is very complex. In order to understand this complexity, humans usually try to visualize the phenomena of nature as a system. A system is a set of interrelated components working together toward some kind of process. One of the simplest forms of a system is a model. Both models and systems are simplified versions of reality. The interaction between perceptible phenomena and theory is accomplished through explanation and validation. This simple model, while an extreme abstraction of reality, illustrates how scientific understanding works. It suggests that in scientific understanding, perceptible phenomena and theory interact through explanation and validation.

In physical geography and many other fields of knowledge, systems and models are used extensively as aids in explaining natural phenomena around us. A system is a group of parts that interact according to some kind of process. Systems are often visualized or modeled as component blocks with some kind of connections drawn. All systems have the same common characteristics. These common characteristics are summarized below:

All systems have some structure.

All systems are generalizations of reality.

They all function in the same way.

There are functional as well as structural relationships between the units of a system.

Function implies the flow and transfer of some material. Systems exchange energy and matter internally and with their surrounding environment through various processes of input and output.

Function requires the presence of some driving force or some source of energy.

All systems show some degree of integration.

Within its defined boundary the system has three kinds of properties: Elements are the kinds of things or substances composing the system. They may be atoms or molecules or larger bodies of matter—sand grains, rain drops, plants, or cows. Attributes are characteristics of the elements that may be perceived; for example: quantity, size, color, volume, temperature, and mass. Relationships are the associations that exist between elements and attributes based on cause and effect.

The state of the system is defined when each of its properties (for example, elements, attributes, and relationships) has a defined value. Scientists have examined and classified many types of systems. These types include the isolated system, a system where there are no interactions outside its boundary layer. Such systems are common in laboratory experiments. A closed

system is closed with respect to matter, but energy may be transferred between the system and its surroundings. Earth is essentially a closed system. An open system is a system where both matter and energy can cross the boundary of the system. Most environmental systems are open.

A morphological system is a system where we understand process relationships or correlations between the elements of the system in terms of measured features. A cascading system concerns the movement of energy and/or matter from one element to another and understands the processes involved. A process-response system involves the movement, storage, and transformation of energy and matter and the relationships between measured features in the various elements of the system. A control system is a system that is intelligently manipulated by humans. An ecosystem is concerned with the biological relationships within the environment and the interactions between organisms and their physical surroundings.

## STRUCTURE OF SYSTEMS

Systems exist at every scale of size and are often arranged in some kind of hierarchical fashion. Large systems are often composed of one or more smaller systems working within its various elements. Processes within these smaller systems can often be connected directly or indirectly to processes found in the larger system. A good example of a system within systems is the hierarchy of systems found in the universe.

At the highest level in this hierarchy, we have the system that we call the cosmos or universe. The elements of this system consist of galaxies, quasars, black holes, stars, planets, and other heavenly bodies. The current structure of this system is thought to have come about because of a massive explosion known as the Big Bang and is controlled by gravity, weak and strong atomic forces, and electromagnetic forces.

Around some stars in the universe we have an obvious arrangement of planets, asteroids, comets, and other material. We call these systems solar systems. The elements of this system behave according to set laws of nature and are often found orbiting around a central star because of gravitational attraction. On some planets conditions may exist for the development of dynamic interactions between the hydrosphere, lithosphere, atmosphere, or biosphere.

We can define a planetary system as a celestial body in space that orbits a star and that maintains some level of dynamics between its lithosphere, atmosphere and hydrosphere. Some planetary systems, like

the Earth, can also have a biosphere. If a planetary system contains a biosphere, dynamic interactions will develop between this system and the lithosphere, atmosphere, and hydrosphere. These interactions can be called an environmental system. Environmental systems can also exist at smaller scales of size (for example, a single flower growing in a field could be an example of a small-scale environmental system).

The Earth's biosphere is made up of small interacting entities called ecosystems. In an ecosystem, populations of species group together into communities and interact with each other and the abiotic environment. The smallest living entity in an ecosystem is a single organism. An organism is alive and functioning because it is a biological system. The elements of a biological system consist of cells and larger structures known as organs that work together to produce life. The functioning of cells in any biological system is dependent on numerous chemical reactions. Together these chemical reactions make up a chemical system. The types of chemical interactions found in chemical systems are dependent on the atomic structure of the reacting matter. The components of atomic structure can be described as an atomic system.

## ENVIRONMENTAL SYSTEMS

An environmental system is a system where life interacts with the various abiotic components found in the atmosphere, hydrosphere, and lithosphere. Environmental systems also involve the capture, movement, storage, and use of energy. Thus, environmental systems are also energy systems. In environmental systems, energy moves from the abiotic environment to life through processes like plant photosynthesis. Photosynthesis packages this energy into simple organic compounds like glucose and starch. Both of these organic molecules can be stored for future use.

The chemical energy of photosynthesis can be passed on to other living or biotic components of an environmental system through biomass consumption or decomposition by consumer organisms. When needed for metabolic processes, the fixed organic energy stored in an organism can be released to do work via respiration or fermentation. Energy also fuels a number of environmental processes that are essentially abiotic: for example, the movement of air by wind, the weathering of rock into soil, the formation of precipitation, and the creation of mountains by tectonic forces. The first three processes derive their energy directly or indirectly from the sun's radiation that is received at the Earth's surface. Mountain building is



fueled by the heat energy that exists within the Earth's interior. Finally, the movement of energy in environmental systems always obeys specific thermodynamic laws that cannot be broken.

It is understood that environment is the complex of physical, chemical, and biotic factors (such as climate, soil, and living things) that act upon an organism or an ecological community and ultimately determines its form and survival. Both human and physical geography provide an important intellectual background for studying the environment. Many environmental studies/science programs offered by universities and colleges around the world rely on the information found in various geography courses to help educate their students about the state of the environment.

### FUTURE OF PHYSICAL GEOGRAPHY

The following describes some of the important future trends in physical geography research:

*Applied geography.* Continued development of applied physical geography will help analyze and correct human-induced environmental problems. A student of applied physical geography uses theoretical information from the field of physical geography to manage and solve problems related to natural phenomena found in the real world.

*Remote sensing.* Advances in technology have caused the development of many new instruments for the monitoring of the Earth's resources and environment from airborne and space platforms. The most familiar use of remote sensing technology is to monitor the Earth's weather for forecasting.

*Geographic Information Systems.* A GEOGRAPHIC INFORMATION SYSTEM (GIS) merges information in a computer database with spatial coordinates on a digital map. Geographic Information Systems are becoming increasingly more important for the management of resources.

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## Pitcairn Island

PITCAIRN (18.1 square mi or 47 square km) is an isolated island located in the east-central PACIFIC OCEAN, approximately 400 mi (644 km) southeast of Mangareva, the closest inhabited island. Pitcairn is the only inhabited island of the British colony of Pitcairn, Henderson, Ducie, and Oeno Islands. The three outer islands of the Pitcairn Islands lie to the north and northeast of Pitcairn. The island of Pitcairn itself is approximately 2 mi (3.2 km) long and 1 mile (1.6 km) wide. Pitcairn has no airstrip and no docking facilities.

The island is fringed with high cliffs, with only one small landing place, Bounty Bay near Adamstown, where longboats can be launched to intercept passing freighters and cruise ships. Communication with the outside world is by radiotelephone and e-mail. Pitcairn's climate is subtropical, tempered by southeast trade winds with occasional typhoons during the November-to-March rainy season. The volcanic soils are fertile, supporting subsistence crops of sweet potatoes, sugarcane, oranges, and bananas. The original forest cover has been much reduced because of the clearing of land for cultivation and the use of wood for handicrafts and construction.

Pitcairn Island was settled by Polynesians sometime before the 15th century. Stone tools and other carvings of Polynesian design have been found on the island, but by the 18th century the Polynesian colony had vanished. Pitcairn was discovered by Europeans in 1767 when British captain Philip Carteret passed by but was unable to land. Carteret named the island after Robert Pitcairn, the midshipman who first sighted the island. Robert Pitcairn was the son of Major John Pitcairn, British commander at the Battle of Lexington.

In 1790, Pitcairn was settled by refugees from the famed mutiny on HMS *Bounty*. Nine mutineers, along with 6 Tahitian men and 12 Tahitian women, settled on the island. Immediately following the mutiny, Fletcher Christian, the leader of the mutineers, had set sail for TAHITI where some of the mutineers elected to stay. Christian, however, rightly reasoned that the

British Navy would send ships to look for the *Bounty*'s crew in Tahiti, where the expedition had been sent to gather breadfruit trees for introduction into the British West Indies as a cheap food for slaves. Christian remembered Pitcairn's description from Carteret's writings and, guessing correctly that Carteret had misjudged the island's longitude, set out to find the island. Christian's small colony soon degenerated into violence, with most of the male settlers, English and Tahitian, being killed in fights over the Tahitian women.

When Pitcairn was rediscovered by an American whaler in 1808, only one of the original mutineers was left alive. This mutineer, John Adams, died in 1829, and in 1831 the colony's entire population was removed to Tahiti. Most soon returned to Pitcairn. In 1856, again because of overpopulation, the entire population was resettled on Norfolk Island, between AUSTRALIA and NEW ZEALAND, but many soon returned to Pitcairn. In 1887 the entire population of Pitcairn joined the Seventh-Day Adventist Church. The peak population of 233 was reached in 1937. Because of out-migration, mostly to New Zealand, the population of Pitcairn has been declining ever since. In 2004, seven Pitcairn men, including the island's mayor, a descendant of Fletcher Christian, were convicted of rape and child sexual abuse charges in a divisive and emotional trial conducted by judges imported from New Zealand. Even though some are once again urging the abandonment of the island, Pitcairn remains Britain's sole remaining colonial possession in the Pacific.

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## place

NOTHING IS MORE important to all geography, descriptive or analytical, natural or human, than place or location. Place can be divided into at least three distinct aspects: geometric location defined by precise latitude and longitude; relative location of where a place is relative to other places, especially in the context of his-

tory; and finally, the unique nature of place—a sense of place.

In terms of precise location, geographers use the global grid system of LATITUDE AND LONGITUDE. In addition, the global positioning satellites (GPS) system allows anyone to determine precise global position to within a few meters. GPS is even used by farmers to apply various rates and types of fertilizer and seeds to unique soils and topographic locales on large farms. It also can be (and is) used by insurgents, terrorists, and the military to precisely mark and identify targets.

As the British geographer Gordon East demonstrated in his book *The Geography Behind History*, the importance of place often changes dramatically throughout history. For example, as the focus of world culture, economics and politics shifted from the Mediterranean, many places once of great importance have become historical relics. A city such as Ephesus, once a center of culture, commerce, and even religion, today is nothing more than a tourist attraction. The cause of its decline was a shift of trade from the Mediterranean to Central Asia caused by the rise of ISLAM and a focus that moved to Baghdad, present-day IRAQ). Ephesus's location or place of importance was relative. Rome, once the center of the western world, today is of greatly diminished importance.

A sense of place refers to the psychological and emotional aspects of place. This is the idea that places (or their imagination or romanticization) create unique psychological impacts upon humans. Deserts seem to have consistent impacts in terms of architecture and social values, no matter where they occur—Africa, Asia, North America, South America. The influence of mountains on the imagination, poetry, and art of people around the world is well known. The idea of “Darkest Africa,” or “backward areas” or the characteristics attributed to an ethnic community are example of the sense of place, as well as the ideals of “pure or natural environments,” “dangerous,” “safe,” “holy” or “mystic” places.

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## planning

WHILE PLANNING IN ITS MOST literal form refers to the creation of a plan in an urban context, in reality the term has a far broader and more complicated definition. For example, planning can refer to matters of safety, that is, the prevention of natural disaster, as well as issues such as aesthetics, the environment, suburbanization and transportation.

The history of planning—that is the act of deliberately arranging the urban form for the sake of beauty and/or convenience—can be said to begin with the history of urban settlements and dates for quite literally thousands of years. Instrumental to its adoption were the Romans, who undertook planning for the purposes of civil convenience and military defense. The basic Roman plan consisted of an outer city wall within which were placed a grid of streets, arranged around an open space known as a plaza. Although city walls are no longer a principal element of city planning, the grid form has persevered and is evident in the morphology of many cities, including BARCELONA (SPAIN), the towns and cities of North and Latin America, and Glasgow (Scotland).

However, it is a Greek architect, Hippodamus, who is widely acknowledged as being the father of urban planning through his plan for the settlement of Miletus, a plan that utilized a grid form. Arguably as a consequence of Hippodamus's interest in city design, the art of planning became closely tied to the ideals of architecture, and at particular times of history, this relationship has been further fortified, for example, in the Roman, Renaissance, and Baroque eras. Urban design, for instance—the practice of smaller scale and more three-dimensional spatial design—still retains a largely architectural outlook and is still closely tied to its sister art of urban or town/city planning.

To define planning is extremely problematic in part because of the broad nature of modern urbanism. However, at its most simple, city, town, or urban planning can be said to be a public-based activity that deals with the large-scale design of the built environment within a municipal or metropolitan context. Regional

planning, on the other hand, is very much considered a 20th-century invention, a type of public-based planning that, as its name implies, tends to deal with the distribution of regional activities or infrastructure at, within, and about the largest metropolitan centers. The origins of regional planning center upon the County of London Plan (1943) and Greater London Regional Plan (1944) by Sir Patrick Abercrombie (1879-1957), a former lecturer at the School of Civic Design, Liverpool University. Regional planning is arguably the urban planning of the largest urban places, such is their modern spatial scales.

The term *town planning* was first coined in the early 1900s in Britain as part of the widening professional architectural interest in the built environment, partly a consequence of the Garden City idea by Ebenezer Howard, which was developed in practice by Raymond Unwin and Barry Parker, who were instrumental in the passing of the Housing, Town Planning Etc. Act in 1909—the world's first legislative piece to include town planning in its title. Although early-20th-century town planning was closely associated with Garden City, it has since this time undergone a series of dramatic developments.

By way of example, modernist town planning can be seen to begin after the creation of a European organization, the International Congress of Modern Architecture, in 1928, which not only promoted modernist architectural forms but perceived that urban betterment in the social and economic sense could be attained via the design of buildings and laying out of cities. Charles-Édouard Le Corbusier (1887-1965), for example, was instrumental in the adoption of modernist principles in planning practice.

City planning, on the other hand, is a somewhat different activity from town planning and is generally considered to be the arranging or willful influencing of land-use distribution that can be practiced upon either green-field or brown-field sites (i.e. built or unbuilt urban areas). The Romans are widely noted as being pioneers of this type of planning.

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## plate tectonics

PLATE TECTONICS IS A geological theory that explains many important features of the Earth's surface through the movement of sections of the crust, known as plates. Among the observed data explained by plate tectonics are the known similarities of features on the east and west sides of the ATLANTIC OCEAN, similarities of plant and animal species in areas now too distant for migrations, the locations of volcanoes and earthquakes, the formation of mountain ranges, and the existence of the MID-ATLANTIC RIDGE.

According to plate tectonic theory, the Earth's crust is made up of approximately 30 rigid sections or plates of various sizes. For instance, the PACIFIC OCEAN is mostly one huge plate, and the major continents each lie on their own plates. Very small plates such as the Gorda Plate in the Pacific Northwest are believed to be the last remnants of ancient plates.

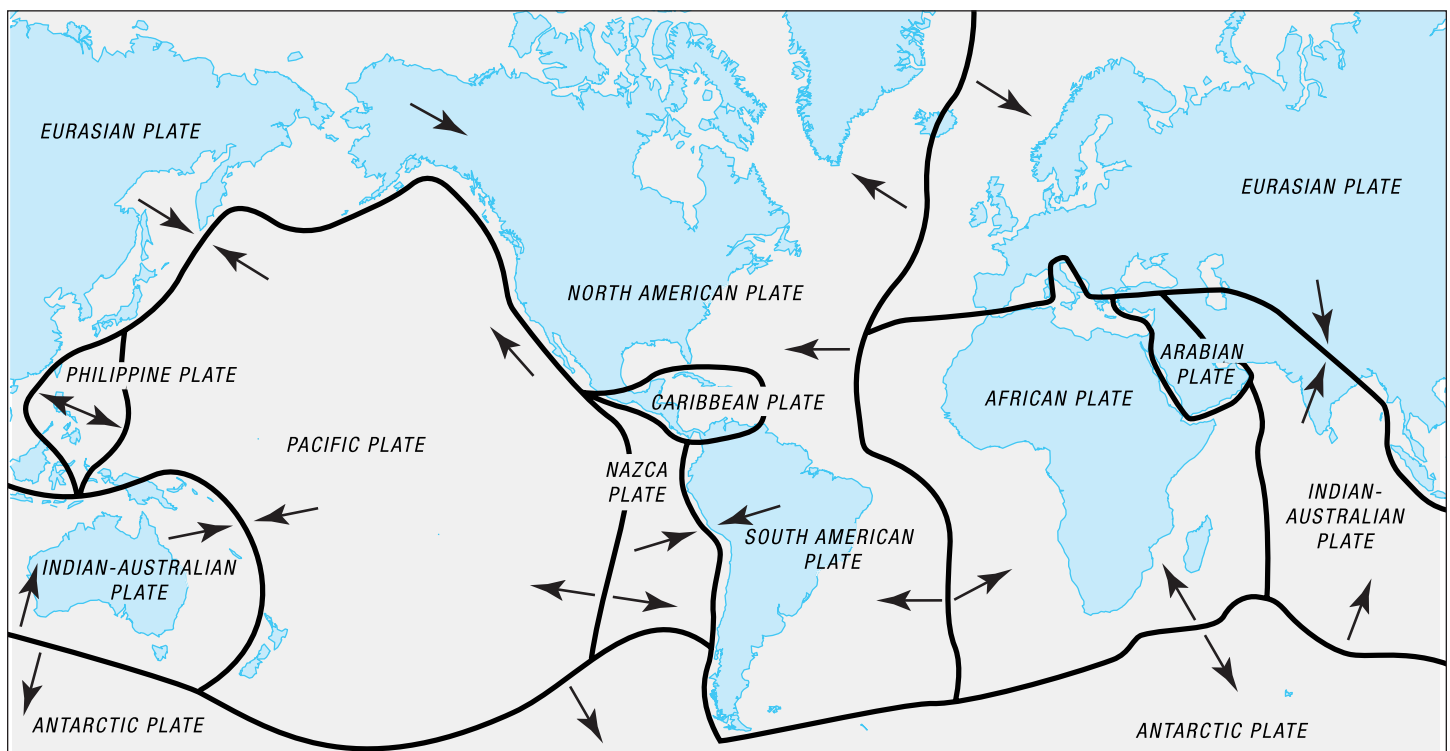
Plates lay over a stratum of hot, elastic rock known as the mantle. Temperatures in the mantle range from 2,400 to 2,600 degrees F (1,300 to 2,000 degrees C), and currents within the mantle drive a slow movement of the plates, at the rate of about 4 in (10 cm) per year.

Although this movement is small in human terms, observable only with sophisticated scientific measurements, over millions of years plates can move great distances, even from one pole to the other.

### PANGAEA

According to plate tectonic theory, about 200 million years ago all present-day continents were part of a supercontinent known as Pangaea or Pangea (Greek for "all-Earth"). Over millions of years, this supercontinent broke up through the creation of rifts, cracks in the crust that moved apart and allowed magma to rise from lower levels and form new seabed. Water moved into the broken landmass to form enclosed bodies of water such as the Gulf of Mexico and the RED SEA. A sufficiently large rift even formed the present-day Atlantic Ocean.

However, since the Earth has not been growing larger, this expansion must cause collisions between plates elsewhere. One of the colliding plates is driven under the other, forming a deep subocean trench beside the resulting subduction zone. The other plate is crumpled and forced upward, forming tall mountains. The HIMALAYAS, the ALPS, and the CAUCASUS all have been



According to plate tectonic theory, the Earth's crust is made up of approximately 30 rigid sections or plates of various sizes. Over millions of years, plates can move great distances, even from one pole to the other.



formed by these geological processes, and in the Himalayas the process will probably continue for the next several million years. Subduction zones form the world's most powerful earthquakes, often near the top of the Richter scale. Seismologists have theorized that deep-focus subduction zone quakes represent the most energy the Earth's crust is capable of releasing. Subduction zones are also responsible for many of the world's volcanoes, particularly the RING OF FIRE that circles the PACIFIC OCEAN and includes the Cascades and Fujiyama.

There are also transform boundaries, at which plates slide against each other. If the two plates become stuck, energy builds up until it releases catastrophically in an earthquake. One of the best-known examples of a transform boundary is the San Andreas Fault in California. Land on the western side of the San Andreas actually belongs to the Pacific Plate, which is slowly sliding north in relation to the North American Plate, but in an irregular way punctuated by destructive earthquakes such as the 1905 San Francisco quake, the 1989 Loma Prieta quake, and the 1994 Northridge quake.

Even volcanoes and earthquakes within plates have been shown to support the theory of plate tectonics. Volcanoes within a plate are created where a rising current known as a mantle plume burns a hot spot in the crust. As the plate moves, it generates a series of volcanic islands, with the older ones eroding away as they are no longer replenished by eruption. The Hawaiian Islands are an example of this process. The big island of Hawaii is still growing as a result of its active volcanoes, while older islands have only extinct volcanoes, such as Punchbowl Crater on Oahu. The westernmost islands, such as Midway Island, have been reduced to tiny spits of land, while the chain continues westward in a series of seamounts that no longer break the surface. Earthquakes within a plate, such as the famous 1811–12 New Madrid quakes, are caused by compressional stresses of plate movement building up within the plate. Such earthquakes can be very destructive because the central part of the plate transmits seismic energy far more efficiently than the broken crust near a plate boundary.

Some geologists have even gone beyond Pangaea to reconstruct the protocontinents that existed before it. Some theories have gone back as far as the Cambrian era, 600 million years ago. In doing so, they are able to explain the existence of such ancient mountains as the Urals and the Ozarks which now lie firmly embedded in the heart of a continental plate. Those mountains are the last bits of evidence of ancient plates otherwise

consumed by subduction. The theory of continental drift was originally proposed in 1912 by Alfred Wegener, a German scientist, but he thought in terms of the continents plowing through the seas like ships.

Although he was ridiculed, studies of sea-floor sedimentation in the 1930s and 1940s suggested that the Atlantic was a relatively young ocean, compared to the age of the Earth. Studies of paleomagnetism, in which the magnetic particles in igneous rock reveal the alignment of the Earth's magnetic field at the location where the rock originally solidified, enabled geologists to reconstruct past land movement across millions of years. The 1969 study of the Mid-Atlantic Ridge by the *Glomar Challenger* led to general acceptance of the theory of plate tectonics.

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## plateau

A PLATEAU IS A LARGE area of mostly level land elevated high above the surrounding land. Most plateaus have one steeply cliffed side. The rock layers in a plateau are un-deformed and remain flat, unlike the rock layers in mountains, which are tilted. Basaltic plateaus are formed when molten rock forces its way up through a fissure, or crack, in the Earth's surface. The molten material flows out slowly, blanketing a large area with a thick layer of lava. When the lava cools, it forms a dark gray rock called basalt. In order for a plateau to form, the area needs to be uplifted slowly so that all layers are folded to make a flat top.

Plateaus can also be formed when plates of the Earth's crust collide. This causes the crust to buckle. Mountains may be formed, but in the area behind the collision area, a plateau is often created. Erosion can also cause a large flat surface of the Earth to uplift. If rivers cut deeply into the Earth, the area around it becomes raised above the surrounding land. Faults and erosion can divide a plateau into smaller plateaus. Also

a plateau may be eroded into a smaller landform known as a mesa or a butte. Plateaus in humid areas can have many mountains, caused by erosion from rivers. Erosion can form canyons in a plateau when a river eats deeply into the Earth. The edges of plateaus on the shore can be shaped into peninsulas and bays by the action of the ocean waves.

Some well-known plateaus include the TIBETAN PLATEAU in Asia and the Colorado and Columbia plateaus in the UNITED STATES. Scientists believe that for the past 50 million years, since a collision between Asia and INDIA, the Tibetan Plateau has been forming. The plateau is the largest and highest plateau in the world. It measures about 2,175 mi (3,500 km) by 932 mi (1,500 km) and the average elevation is more than 16,400 ft (5,000 m). It is located next to the Himalayan Mountains.

The Columbia River Plateau in the northwestern United States formed when lava flowed from fissures in the earth's surface about 17 million years ago. The lava covered an area approximately 63,321 square mi (164,000 square km) and in some places is about 11,483 ft (3,500 m) thick. The plateau covers parts of the states of WASHINGTON, OREGON, and IDAHO.

The Colorado River Plateau is made up of colorful sedimentary rocks formed millions of years ago when much of the western United States was covered by a vast ocean. The most spectacular feature of the Colorado Plateau is the GRAND CANYON, carved away by the Colorado River. Plateaus are formed in different ways and look different, but they all are relatively flat and are formed of unbroken layers of rock.

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## playa

PLAYAS ARE SHALLOW basins that periodically fill with rainwater. They have been described as among the most dynamic geomorphic features, reacting to seasonal and sometimes daily changes in the environment. The term *playa* owes its origin to the Spanish word for

"beach" or "shore." A large number of playas began as lakes, drying later as a result of climate change or a reduction in stream inflow. Playas captured the imagination of geologists such as Israel Cook Russell during early (1890) investigations of the western U.S. states. The ubiquitous occurrence of playas throughout the world has led to a variety of regional terms. For example, in CHILE and other Spanish-speaking countries they are called *salar*, in North Africa *sabkha*, and in IRAN *kavir*. It is estimated that there are approximately 50,000 playas on Earth; the majority are less than 1 square mi (2.6 square km) in size.

Playas frequently have annual evaporation to precipitation ratios exceeding 10 to 1. Unlike perennial lakes that are fed by rivers and streams, the water in playas is supplied through rainfall. A nearly impermeable layer of clay on the surface of playas prevents water from percolating downward. In the absence of streamflow or frequent precipitation, the water evaporates quickly, leaving basins dry until rain renews the cycle. Winds remove loose surface particles through deflation.

Climatic conditions favorable to playa formation can be found in tropical and subtropical areas of high pressure with latitudes from 35 to 15 degrees. Playa basins originate in a variety of ways, including downwarping, faulting, and deflation. Subsidence and solution processes can also result in playa formation in areas with underlying limestone or gypsum. Many playas represent the remnants of immense lakes that formed from melting Pleistocene glaciers. The former Lake Manly, the site of present-day Death Valley, extended more than 100 mi (160 km) in length and 600 ft (182 m) in depth and was sustained by three rivers carrying meltwater from Sierra Nevada glaciers. As the climate became drier, the lake disappeared through seepage and evaporation.

The arid appearance of playas may create an impression that they are hydrologically inactive. In reality, playas play an important role in arid-zone hydrology. Where groundwater is found close to the surface, playas discharge large amounts of capillary water into the atmosphere. Playas also play a role in the circulation of groundwater. Occasional flooding of playa surfaces removes surface evaporite accumulations.

Early human use of playas has focused on the harvesting of salt. Playas with large salt accumulations, known as saline playas or salinas, are sources of borax, nitrates, and potash. Playas are also important resources for agricultural operations in arid regions. Al-

though playas themselves are not suitable for growing crops, they are often used to store runoff water for later use. They may also serve as surface focal points for recharging aquifers. In the UNITED STATES, playas have been used for automobile speed trials or as landing sites for experimental air and spacecraft.

The Bonneville Salt Flats in UTAH is the site of land speed records, while the vast expanse of Edwards Air Force Base in CALIFORNIA has been an ideal location for testing military aircraft. In the western United States, playas have been impacted by the widespread lowering of the water table and by the migration of vegetation.

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## Pleistocene geography

THE PLEISTOCENE EPOCH was Earth's most recent Ice Age. The epoch began around 1.8 million years ago (mya) or 2.6 mya. Traditionally, scientists have based the starting date of the epoch on faunal grounds and have estimated it to be about 1.8 mya. A growing number of climate scientists and glaciologists tend to use 2.6 Mya, a time when there was a rapid buildup of ice in the Northern Hemisphere.

There is general agreement that the Pleistocene ended about 10,000 years ago, when temperatures similar to modern times became the norm. The geography of the Pleistocene is of great interest to us for the sheer magnitude of ice coverage, the epoch's wide swings in temperature, and its impacts on the land, people, and animals of the time. Additionally, Earth is presently in a warm, interglacial period, but climate scientists believe that in about 10,000 years or so we could be in the midst of another ice advance; thus, studying the Pleistocene helps us understand humankind's past and contemplate its future.

Climate scientists estimate that the Pleistocene ice sheets covered about 25 to 30 percent of today's land

surface. The modern-day ice sheets—the eastern and western Antarctic ice sheets and the Greenland ice sheet—cover only 10 percent of the land. Six or seven ice sheets existed in the Northern Hemisphere 21,000 years ago, when the last glacial maximum occurred. By far the largest ice sheet, the Laurentide, stretched over east-central CANADA and part of the UNITED STATES. Another ice sheet, the Cordilleran, covered the northern Canadian islands, the Rockies of Canada, and parts of MONTANA and IDAHO in the United States. The Greenland ice sheet covered the island of GREENLAND.

The Britain ice sheet spread out over the islands of Britain and IRELAND. The Scandinavian ice sheet spread from NORWAY, SWEDEN, and FINLAND across most of the North European Plain and western RUSSIA. A sixth ice sheet, the Barents-Kara, overlapped north-central Eurasia's northern continental shelf and mainland. A seventh glacier—the East Siberian—might have existed separately from the Barents-Kara sheet. End moraines, glacial lake varves, and carbon-14 dating document where the southern edges of the ice sheets were. In contrast, the positions of the sheets' higher latitude margins are the subject of much scientific debate. The Laurentide and Cordilleran ice sheets may have fused together. The Britain, Scandinavian, and Barents-Kara ice sheets may have also joined.

In addition to Pleistocene ice sheets, mountain glaciers of that time were more numerous at lower latitudes than today. Large highland ice caps draped the summits of the ALPS, South Island of NEW ZEALAND, HIMALAYAS, southern ROCKY MOUNTAINS, and the southern and central ANDES. In addition, small alpine glaciers were more widespread in the tropics and middle latitudes than today.

The Pleistocene epoch's temperatures were cooler than now, but not uniformly so, as repeated episodes of interglacial warmth punctuated its history. Computer models tell us that during glacial advances, global average surface-water temperatures were 9 or more degrees F (5 degrees C) cooler than today. Air over the land was even cooler. For instance, average temperatures of North America were at least 14 degrees F (8 degrees C) cooler. Sea ice was extensive: It was possible to walk from the Brittany coast of FRANCE to IRELAND, for instance. In contrast, the southern limit of sea ice in the present interglacial period is just slightly south of Greenland. Sea ice was farther north in previous interglacials, as temperatures were 2 to 5 degrees F (1 to 3 degrees C) warmer than the present. The warmth of the Pleistocene interglacials resulted in higher evaporation rates and more intense monsoon winds areas than

those of today. For instance, during the last Pleistocene interglacial period, stronger monsoon winds delivered significantly more rainfall to subtropical and middle latitude regions. As a result, large lakes, lush savanna grasses, and riparian woodlands covered areas that are now desert, such the SAHARA DESERT of northern Africa and the Mojave Desert of the U.S. southwest.

### ERODED LANDSCAPES

Pleistocene glaciers left behind eroded landscapes in high latitude and alpine landscapes: thin soils, large exposures of ice-scoured rocks, countless lakes, and steep-walled fjords. Additionally, mountain glaciers created signature cirque basins, U-shaped valleys, narrow-crested arêtes and steeple-sharp horns. Rubble of interlobate and end moraines chronicle the size and extent of the glaciers. Moreover, table-flat beds of proglacial lakes and outwash plains, abandoned meltwater channels, sinuous eskers, kames, kettles, and valley trains attest to the voluminous glacial melting that took place after the last glacial maximum.

The rising temperatures that ended the Pleistocene epoch shrank the arctic tundra and cold-tolerant coniferous forests. Simultaneously, there was a dramatic expansion in the boundaries of warmer climes—tropical rainforests, subtropical deserts, and middle latitude forests.

The end of the Pleistocene also witnessed the extinction of many cold-tolerant mammals: the mastodon, woolly mammoth, true horses, saber-toothed tigers, large wolves, giant armadillos, as well as giant ground sloths and ancient bison, camels, and wild pigs. Biological and cultural evolutions of early human beings also took place during the Pleistocene. Humans' evolving intelligence, as well as hunting and gathering technology, enabled them to adapt to a rapidly changing environment and to spread to all the continents (except ANTARCTICA) before the Pleistocene epoch ended.

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## Po Valley

THE PO RIVER VALLEY is the largest and most important economic region in ITALY. It is the center of most Italian industry as well as Italy's agricultural heartland. More than 16 million people—nearly a third of all Italians—live in this fertile basin, in which are located 12 cities with populations surpassing 100,000, including Turin and Milan, with populations over 1 million.

The river itself is not among the longest rivers in Europe, running 405 mi (652 km) from west to east, but together with its 141 tributaries, the Po catchment area stretches across 27,000 square mi (70,000 square km). The river's agricultural and industrial importance has played a primary part in the political and social history of Italy—the basin today accounts for 40 percent of the nation's gross domestic product—but suffers serious environmental consequences through poor water management, industrial and sewage pollution, and agricultural runoff.

The Po River, called the "Padus" in Latin—the origin of the term Val Padana ("Po Valley")—begins as a swift mountain stream in the Cottian Alps on the border with FRANCE, near the peak of Monviso (12,602 ft or 3,841 m). It flows east and north to Turin, a major manufacturing town, then continues east across the Piedmont region, joined by several small rivers flowing down from the ALPS to the west or north. Near Alessandria, it is joined by the river Tamaro, which flows from the south, originating in the Apennines. From this point east, the Po's tributaries continue to be differentiated between those that flow from the Alps to the north and those that rise to the south in the Apennines, with very different characteristics, notably, differences in seasonal flood patterns.

The major Alpine tributaries are (from west to east): the Ticino, Adda, Oglio and Mincio. The headwaters of these rivers generally form the northern boundary of Italy with SWITZERLAND, with the exception of the Ticino, which flows through the southern Swiss canton of the same name. Each of these rivers also flows through a major lake at the point at which the mountains reach the upper Po Valley Plateau (also from west to east): Maggiore, Lugano, Como, Iseo and Garda. These lakes are popular among tourists for their cool climate and rich mountain scenery. The major cities in this region, north of the Po, are located between the major rivers: Novara, Milan, Monza, Bergamo and Brescia, plus the smaller but important historic cities of Cremona and Mantova (Mantua).



The major rivers that flow from the Apennines to the south—usually swifter and with heavier sediment—are (from west to east) the Trebbia, Taro, and Secchia. Major cities on these rivers are Piacenza, Parma, Reggio nell’Emilia, and Modena. The last 75 mi (120 km) of the Po Valley is a narrow corridor to a broad delta on the ADRIATIC, in which the main city is Ferrara. Two other river basins hem in this corridor to the north and south, whose mouths are so close to those of the Po that they can really almost be considered part of the same drainage basin: the Adige, which drains much of the Veneto and northeastern Italy, and the Reno, which collects several of the rivers of Romagna. If these basins are included within the wider Po Valley, even more famous Italian cities can be added to the list, including Bologna and Verona.

### IRRIGATION

Parts of the Po River Delta and the Val Padana have been drained for agricultural purposes since Roman times. The Po Valley is Europe’s largest rice-growing region, requiring significant amounts of water to be diverted from the river and its tributaries, but even larger amounts of water are diverted for industrial purposes, for example, for the large automotive industry in Turin.

Flooding has always been a major issue in the Po Valley, especially in spring when melted snow and ice from the Alps can double the river’s flow within hours. Extensive dykes and levees have been built to curb this problem, along with river straightening projects to aid navigation, but these have mostly served to shift the flooding along to other parts of the river. In 1989, the Italian Parliament created several new bodies to oversee water management throughout the country; the largest of these was created for the Po River Basin.

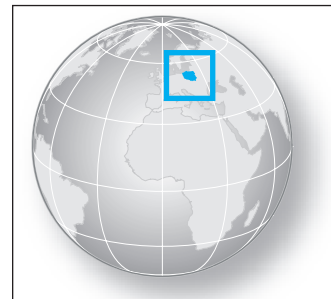
This agency has the monumental task of restoring the environmental balance of the Po and its tributaries while maintaining the viability of 269 hydroelectric plants, 11 thermal power plants, farming activity that accounts for 35 percent of Italy’s gross domestic product, and nearly 40 percent of Italy’s industry.

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## Poland

**Map Page** 1133 **Area** 120,728 square mi (312,685 square km) **Population** 38,622,660 **Capital** Warsaw **Highest Point** 8,199 ft (2,499 m) **Lowest Point** -6.6 ft (-2 m) **GDP per capita** \$9,700 **Primary Natural Resources** coal, sulfur, copper, natural gas, silver.



POLAND IS LOCATED in eastern Europe, and is surrounded by the Baltic Sea to the northwest, GERMANY to the west, SLOVAKIA and the CZECH REPUBLIC to the south, and BELARUS, UKRAINE, LITHUANIA, and RUSSIA to the east. The central portion of the country is relatively flat and is an agriculturally driven area. The Vistula River, Poland’s longest, flows through this area, and drains into the Baltic Sea. The Sudeten Mountains are located in the west and the Carpathian Mountains run along the south.

About 25 percent of Poland is covered by forests. Wild boar, hare, deer, brown bears, and wildcats can be found among the trees, and numerous storks live in the countryside. The climate is very changeable. A continental climate from the east influences the weather, as well as the maritime climate from the west. Central Poland is the driest area in the country, and the mountain regions receive much rain and snow.

Poland’s history can be traced to the reign of Mieszko who converted to Christianity in 966 C.E. During the 14th century, Casimir III the Great built an extensive network of castles and fortifications and one of the first European universities at Krakow. The early Polish state, existed until it was partitioned by Prussia, Russia, and AUSTRIA, in 1795.

After World War I, Poland declared its independence and was under authoritarian rule. On August 23, 1939, the German and Soviet government signed the Ribbentrop-Molotov nonaggression pact. This pact secretly separated Poland into Soviet and Nazi controlled zones. On September 1, 1939, the German army marched into the Poland and on September 17, Soviet forces invaded the eastern section of the state. The Soviet troops were eventually overrun by German troops in June 1941.

During the war, exiled Poles created a resistance movement. Some 400,000 Poles fought for the Soviets and 200,000 fought on the western front. However, in 1943, the Soviets broke relations with the Polish gov-



*Gdańsk, Poland, is the birthplace of the Solidarity movement, which helped overthrow communist control over the country.*

ernment and in July 1944, Soviet troops reentered sections of Poland and created the communist-controlled Polish Committee of National Liberation. The Polish citizens who remained in Poland during World War II were brutally treated by the Nazis. About six million Polish Jews were killed and 2.5 million were deported to Germany, where they faced work at forced-labor camps.

After World War II, the Polish Provisional Government of National Unity was formed. Free elections were planned two years later but never occurred. The Communist Party had begun to enforce its rule over the citizens. During 1956, the communist hold over Polish politics seemed to lessen its grip as a period of

liberalization occurred under First Secretary Władysław Gomułka. However, this was short-lived, when in 1968, a series of student demonstrations were suppressed. In 1970, many Polish citizens became upset with the living and working conditions in the country, and Gomułka was replaced with Edward Gierek.

During the first half of the 1970s, Poland's economic growth rate was one of the highest in the world. Western credit was infused into the economy, but much of the capital was misspent in the centrally planned economy. As the decade progressed, the country's debt became a major problem and the economic growth halted.

By July 1980, the foreign debt was more than \$20 billion, and workers became incensed over the rising prices. Throughout the summer, a series of strikes took place across the nation. On August 31, 1980, workers at a shipyard in Gdańsk, led by Lech Wałęsa, signed an agreement, which guaranteed the right for the workers to create an independent trade union. Other agreements were created as the Solidarity movement grew. Ten million Polish citizens, including 1 million Communist Party members, joined the Solidarity trade union.

As discontent grew with the corruption in the government, Gierek was replaced as first secretary by Stanisław Kania. The Soviet military also moved along the Polish border, and in December 1981, after the Polish regime declared martial law, the Red Army moved into Poland to eliminate the union. Many of the union leaders, including Wałęsa, were taken prisoner, and Western countries, including the United States, imposed economic sanctions on the Polish Communist regime and Soviet Union.

One year later, martial law was suspended, and for the next two years, prisoners were slowly released. However, the seeds of the Solidarity movement could not be eliminated, and by 1988, strikes once again occurred throughout the country. As the Soviet and communist influence in Eastern Europe was dwindling with a surge of democracy, a new government led by non-communists was created in 1989.

The Polish government changed its economy from being centrally planned to free-market-based. In May 1990, the local elections were free, and the Solidarity Citizens' Committee was successful in winning a majority. In December 1990, Lech Wałęsa became the first democratically elected president in the history of Poland.

Throughout the 1990s, Poland made strides in achieving a democratic government and a market econ-

omy. In 1995, Walesa was defeated by the Democratic Left Alliance candidate, Aleksander Kwasniewski. After a brief departure from the presidency between 1995 and 1997, Kwasniewski regained the presidency and was in power as of 2005. The economy grew rapidly into the mid-1990s with an economic “shock therapy” program but then slowed, which resulted in a rise of unemployment. Throughout its transition process, the United States and other Western nations have reduced Poland’s foreign debt and provided economic aid. Trade barriers have also been lowered.

The outlook for Poland seems extremely bright. As the country joins the EUROPEAN UNION, the economy continues to make strides. After hundreds of tumultuous years, Poland seems destined for economic and political success in the 21st century.

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## political geography

POLITICAL GEOGRAPHY IS the study of the ways geographic space is organized within and by political processes. It focuses on the spatial expression of political behavior. Boundaries on land and on the oceans, the role of capital cities, power relationships among nation-states, administrative systems, voter behavior, conflicts over resources, and even matters involving outer space have politicogeographical dimensions.

Contemplating the state of political geography, Richard Muir observed that “political geography is simultaneously one of the most retarded and most undervalued branches of geography and one that offers the greatest potential for both theoretical and practical advance.” Things had not always been so. Many of the early geographers such as Peter Kropotkin, Sir Halford J. MACKINDER, and Isaiah Bowman were explicitly concerned with the relations between politics and geography in both their published work and their public lives.

Mackinder, for example, was a member of parliament, a high commissioner in RUSSIA and chairman of various government committees, and Bowman was an adviser to President Woodrow Wilson at the Versailles

Peace Treaty meetings. Sadly, this concern with the very stuff of politics waned after Mackinder and Bowman. Geopolitics became discredited by a Nazi association and political geography became an ossified subdiscipline of a tired subject, often taught, never researched, a prisoner of outdated theories.

From the disciplinary perspective, political geography may be defined as either geography or political science. In the perspective of political science, political geography appears as “the study of political phenomena in their aerial context,” as one geographer put it.

## FUNCTIONS AND FACTORS

Political geography is the study of relationships among humans, their environment, and their political institutions. The controversy over states’ rights, which has been revived again and again in the UNITED STATES, masks geographic problems growing out of the natural environment of the southern states, or out of natural resources of petroleum-producing states, or out of water requirements in dry and semiarid states. All these and more require political accommodation.

The functions of political geography are not confined to one state but embrace the whole globe. It is intriguing to attempt to rank the sovereign states of the world in terms of effective national power, to evaluate the regional importance of one state compared to its neighbors, to range over the world and consider the ever changing power of the (British) Commonwealth of Nations, or the French Community, to analyze the reasons for political tensions between regions in terms of environmental differences—these are the substance of political geography in its broadest terms.

The subject is also dynamic, searching for the effects of change and the rate of such change. Change affects, in every inhabited spot, the elements within the political state that define it, that strengthen or weaken it, that slowly alter the image of a state in the world. The nature of change and its velocity are both little understood, for humans are cursed with a love of the familiar, the usual and ingrained, and their grasp is finite and time bound.

The political requirements of agrarian ARGENTINA altered internally and externally when the Juan Peron government attempted to industrialize the state. The political geography of the (British) Commonwealth of Nations today contrasts in stress and strain with the 19th-century BRITISH EMPIRE. Changing geographic resources and factors buttressed the weapons race between the UNITED STATES and Soviet Union during the Cold War. Political demands for control of French



Louisiana in the early 19th century grew out of the MISSISSIPPI RIVER's role as a transport route for farm products. Today, an interstate superhighway system is of more importance to the agriculture areas of the Midwest than southward river routes. The political importance of the differing economic developments of communist CHINA and democratic INDIA causes scholars to question the suitability of one type of government over another.

Yet scholars admit that the political state is in one sense an abstraction, dependent on written records and some degree of respect for possession or ownership. It could not exist in a world without other political states. As an abstraction, it appears at a certain level of culture, marked by written language, sedentary life, and the need for organization. Today, in certain areas of the world, it appears to be only another stage in the search for unity by groups of people. In newly born states it is national unity. The painfully complex path of Western Europe toward federation is a movement toward regional unity. The latter's course contrasts sharply with the turbulent, uneasy history of newly independent nation-states of the former Soviet Union.

Political geography is functional; it studies the degree of unity reached by the environment and man's political institutions. Laws governing the ownership of water rights that were evolved in moist, cool northwest Europe were unsuccessfully transplanted to the American semiarid southwest. In much of Latin America, most of the land is owned by a small wealthy class. The resultant pressure of population on resources is a continuing specter that threatens to menace the productivity of the environment and to conjure up political revolution.

Subordinate political units in the state also clash with man's use of the environment. It can be witnessed in the U.S. urban trading areas that overlap several states; interstate compacts regulating commerce, navigation, and transportation; and overlapping regional requirements for development of natural resources such as river basins. Above all, there is the increasing role of central political power in the modern industrialized states, which has been forced primarily by the interregional complexities of economic and social problems.

Political geography considers different cultural meanings for similar political and geographic functions. Attitudes, frames of reference, habits, and beliefs—all the rationale of political and cultural action—are explored for their agreement or disagreement with the environment. America, in the colonial

period, offered the natives hunting and fishing; to the colonists, it offered farms, lumber, cotton, and tobacco. The prairies of the Midwest or of western CANADA, with their thick, deep-rooted grass, have a different meaning to the settler today than what they had before the invention of the steel plow. These lands were first unsuitable, then invaluable, for profitable settlements. The former accommodates to local tribal government by the patriarch; the latter is the agent of highly centralized, democratic government that is over 1,200 miles distant.

The pace of change today is forcing many peoples to reorient their customs and habits. Unfortunately, cultural inertia often produces only a veneer of change. The oil-rich sheiks of the Arabian peninsula gladly accept the costly consumer goods of the West; many a Cadillac has not been uncrated or may have been run dry of gasoline and abandoned. The distrust of the strange, the foreign, and the unusual continue to haunt most of the world's peoples.

Though moderated after centuries of conflict, religion remains contentious over vast areas. The idea of race, expressed in terms of color of skin and physiognomy causes rioting, murder, economic and social discrimination, and political bias in many countries. Despite the general rise in literacy and the construction of educational systems and rapid communications structures, there probably has not been a corresponding increase in the level of understanding and tolerance. Not less important, and among the slowest to change, are those series of conventions that society impresses upon individuals. These force the control or submission of the instinctive impulses, for the most part, for the general social good.

The political geographer is concerned with the homogeneity and heterogeneity in action within and without the political unit. He or she must attempt to analyze the centrifugal and centripetal forces acting and interacting at different rates.

## EVOLUTION AND DEVELOPMENT

Humans remained a pawn of their environment for thousands of years before they became sedentary. Security lay with the tribe and idol, and fears led to primitive worship. The arrival of sedentary agriculture provided the grounding to develop small groupings, implying an intimate association with a single homogeneous landscape. In river valleys such as the NILE, Tigris-Euphrates, INDUS, and HUANG, these collective groupings evolved political forms that were linked to the physical settings of FLOODPLAINS, the presence of



abundant water, the yearly silting of the fields, and the regularity of the sun and the seasons.

The hold of the primeval past remained strong even in the Greek world of Persian invasions, in the lifetimes of Pericles, Plato, and Aristotle. The Greeks were the first known culture to actively explore geography as a science and philosophy, with major contributors including Thales of Miletus, Herodotus, Eratosthenes, Hipparchus, Aristotle, Dicaearchus of Messana, Strabo, and Ptolemy. But Greek scholars began to think logically and abstractly about the meaning of the world around them. Both Plato and Aristotle analyzed the political state, its environmental base, and man's relationships with it. They attempted to clarify cause, space and time.

Although the political world of their day became complex, they agreed to find unity among environment, man, and the state. The polis, the city-state, was their political frame of reference. The influence of topography in fragmenting the Greek peninsula into many small river valleys, separated by hills and mountains but facing the sea, has also been commented on many times. Yet, even for the Greeks it was true, as it is increasingly today, that humans are active, intelligent agents, not the pawns of their environment.

Whenever we study the thought of other people in other cultures and at other times, their frame of reference must be considered to explain their limitations and successes. Greek thinkers were no exception. An early comment on the political environment by Aristotle was both nationalistic and deterministic. He asserted that "the people of cold countries generally, particularly those of Europe, are full of spirit but deficient in skill and intelligence; and this is why they remain free, but show no political development and faculty of governing others. Peoples of Asia are endowed with intelligence but are deficient in skills. This is why they continue to be peoples of subjects and slaves." Aristotle's Europeans were those nomadic tribes in south Russia and the Balkans that periodically raided the Mediterranean world and threatened its colonies. He implied that nomadic tribes are not likely to develop a high degree of political organization. His Asians were the peoples of Asia Minor and the Persian Empire. The first of these were his own people, inhabitants of Greek city-states along the fringe of Anatolia—yet he looked down on them.

Today, we would consider the low level of technology at that time as important, one that produced small surpluses but dense populations. The size of these eastern empires contributed to the necessity for a political

organization that depended on a highly centralized monarchy buttressed by military power.

When Aristotle wrote that the Greeks were better than barbarians of the north and the Asians of the east, he emphasized the importance of location; he was writing about the known world. In addition, he believed that climate had a strong influence on qualities such as spirit and intelligence, for in the Greek division of climates, the Greek lived in the temperate zones, the nomad in the cold regions, the Asiatic in the hot areas.

Greek thinkers were cautious of their common nationality, but through most of the ancient period they were more impressed by the consciousness of the value of their individual civic life. The 5th century B.C.E. was the period of highest achievement in Greek political life. Greek unity was imposed by Philip and Alexander of the Macedon. The unity of which Plato wrote was sharply limited in dimension. He was certain that the city-state was the ideal political form for humans. Later, in the age of Caesar and Augustus, the geographer Strabo argued that only with a strong central government with one powerful ruler could a continental empire such as Rome survive and flourish. Through the centuries, humans have altered many times their views on the size, structure, and functions of the political state that they continued to require.

These early observations on the nature of interlinkages between people, the environment, and political institutions could not evolve in a coherent subdiscipline of political geography. The surge of new geography of the 1950s and 1960s bypassed political geography. The new geography, with spatial analysis as its theme, neoclassical economics as its accounting frame, and logical positivism as its methodological underpinning, could not accommodate a political geography. The emphasis of neoclassical economics on the economy as a harmonious, self-regulating system, where each factor of production receives its fair reward, ignored questions of conflict and inequitable distribution, and the focus of logical positivism directed attention to verifiable empirical statements in particular, and data analysis in general, and away from the operation of the more incorporeal power relations within society.

A truly political geography could not flourish in such a climate. Moreover, the explicit analysis of politics was taken over by the last social science discipline, political science. This academic assertion was being conducted by a discipline, which according to some scholars was a device for avoiding politics without achieving science. Ignored by its discipline and lacking

any theoretical substance from political science, it is little wonder that political geography was a moribund subject.

### MODERN POLITICAL GEOGRAPHY

The origins of political geography are usually traced to Friedrich Ratzel (1844–1904), who was the brilliant yet ambiguous founder of modern political geography. He was strongly influenced by rapid, vigorous developments in the natural sciences in the 19th century and sought to discover the realities of political society.

Ratzel and Karl Marx both thought that there were natural laws that controlled society. Ratzel's critics have often disregarded his fundamental contributions to the elements of political geography, underestimated the attention he gave to the factors of location and space, and fixed their disliking on his attempt to develop an analogy between political state and living biological organism. In his native GERMANY, the concept of natural selection and survival of the fittest became wedded to a geopolitical jurisdiction of national expansion.

A group of German geopoliticians emerged who gradually discredited his reputation as they abandoned rationale and unbiased geographic thought and turned to justifications of war and conquest.

Ratzel thought that states in all stages of development are considered as organisms that stand in a necessary connection with the ground, and hence must be viewed geographically. He linked the state to a mobile body, to an organism subject to the natural laws of growth and decay. His organism was spiritual and moral. Just as an organism is born, grows, matures, and eventually dies, Ratzel argued, states go through stages of birth (around a culture hearth or core area), expansion (perhaps by colonization), maturity (stability), and eventual collapse.

Strongly influenced by Darwinian thinking, he was interested in the relationships between the state and the Earth, between political institutions and their physical environment. His major contribution came with his representation of the state as a organism needing *Lebensraum* (living space) and the competition between states for that space as a Darwinian contest involving the survival of the fittest. He suggested that only a sporadic absorption of new land and people could stave off the state's decline. In fact, Ratzel proposed a blueprint for imperialism.

He believed the higher the technological and social development of the political state, the farther that state was removed from its organic foundations. In fact, this

thought on the analogy of an organism and the state is ambiguous. The true geographic structure of Ratzel's thought suffered because of imperfect distillation from his German and from the rejection by American geographers of any form of determinism. However, the elements of political geography that are thought to be of major importance today were voluminously discussed and analyzed by Ratzel. The state is not an abstraction—it occupies land and water; its size, location, and boundaries are important characteristics.

Ratzel also thought that the surface features of the land together with vegetation and soil were basic to any political analysis. He emphasized the importance of capital in location and function. The beliefs of social groups in the necessity of a political union based on historical, religious, and cultural values; the theory of centrifugal and centripetal forces operative in the state; the idea of the *ecumene* or heartland; and the vital roles of communication and movement—all these provide the solid substance of his political geography. He lived in an era that saw the growth of colonial empires to their maximum and the partitioning of virtually all the land areas of the world into politically controlled regions. He correctly saw that the increasing ability to overcome space placed a premium on states of large size. Today, we speak of the continental superpowers that have geographic environments that possess varied and immense resources. In addition, Ratzel devoted attention to relationships between states, particularly on the nature and function of boundaries.

Ratzel's ideas were taken up by a number of geographers with political as well as academic interests, notably Rudolf Kjellen, a Swede, and Karl Haushofer, a German who taught and was close to Rudolf Hess, Adolf Hitler's deputy in the 1930s. They developed a school of *geopolitik*, whose writings were used to give an intellectual rationale to 1930s German expansionism—not only the desire to occupy adjacent territories with substantial German populations, such as AUSTRIA and Sudetenland, but also Russian areas further east.

Parallel developments in the UNITED KINGDOM were led by another geographer-politician, Sir Halford Mackinder (1904), whose classic paper related state power to location. In an era when movement of heavy goods and large armies was easier by sea than by land, maritime countries would dominate politically, but as land transport was becoming easier, so "land-based powers" were becoming stronger: he argued that whoever controlled the "world island" (the heartland of Euro-Asia) should be able to control the globe—a geopolitical notion that influenced much strategic

thinking throughout the century, until air power (and then power in space) came to dominate military strategy.

Elsewhere, political geography merged as the study of states and their impact on the landscape, as exemplified by D. Whittelsey (1939) and by R. Hartshorne's (1950) paper on the functional approach: the latter saw the spatial structuring of the state as a resolution of centrifugal and centripetal forces, focused on its core area and capital city. Many of their writings involved identifying typologies of states and dividing the world into geopolitical regions.

Descriptive analyses of the world political map were continued by a number of scholars who at various times posited bipolar, multipolar, center-periphery, and other structures. Other geographers developed interests in boundary demarcation and disputes, on land and at sea. This continuing strand of work on geopolitics had little impact on the wider discipline, despite its links to strategic thinking. It was almost entirely absent from geography in FRANCE, Germany, and Russia from 1945 onward because of the association of political geography with geopolitics and then geopolitik. The Soviet Union, for example, blocked the establishment of commission on political geography within the International Geographical Union until 1984.

Climatic variations have inspired another set of geopolitical hypotheses and critiques. International political patterns have also been linked with the uneven distribution of the various raw-materials requisites of modern industry. There is some disposition to regard areal differentials in technology as the critical variable, a hypothesis that has been linked with demographic distribution to produce a prediction that international political patterns will ultimately be determined by the latter. The prediction is based on the premise that technological primacy will vary with relative numbers of superior scientists and other gifted individuals varying in the long run with the size of population.

A revival of interests in political geography from the 1970s onward was initially linked to the "quantitative revolution," which the wider discipline experienced in the 1960s and 1970s. Work on ELECTORAL GEOGRAPHY started then and geographers increasingly brought their spatial perspective to bear on a range of subjects broadly defined as "political" and relating in some ways to the operation of the state. Location and conflict (over land uses, public goods, and so forth) became topics considered by political geographers. But a political location theory was not as obvious as an economic, or even a social, one.

New texts in the 1970s also stimulated a broadening of the substantive areas of interests within political geography, with chapters on the geography of law, for example, and on spatial variations in the operation of government programs and government spending. Both depth and breadth were brought to the subdiscipline by this concern with theory, which involved moving away from the treatment of space as a given, as the environment within which states operate, toward a perspective that sees space as produced and reproduced by human action—the world political map is a social production. Two "spatial takes" were particularly relevant in this movement. The first was a treatment of scale. Strongly influenced by world-systems analysis, it was argued that world capitalism is organized globally, mediated and regulated regionally by states, and experienced locally.

The second theoretical perspective was introduced to develop the concept of territoriality to show how bounded spaces (including those of nation states) are crucial to the exercise of political, economic, cultural and military powers. The world is a mosaic of nested containers within which power is exercised and people controlled—with the criterion for whether you are subject to a particular rule of law being whether you are within the territory where it is sovereign. The theory is further analyzed in the light of increased globalization and the consequent changing role of the territorially defined nation state.

The most recent area of expansion has been in the study of critical geopolitics, a further outgrowth of the growing theoretical sophistication within human geography. As John O'Loughlin (1994) illustrates, this involves questioning the assumptions upon which geopolitical strategies are based—not so much the "geographical information" employed as the representations of peoples and places (both "selves" and "others"). These are involved in the creation of identities: images of "us" and "them" (as in the 1945 to 1990 Cold War in which the two major powers and their allies each created images of the other on which to base their policies and around which to mobilize popular support). Geopolitical practices are subjected to critical scrutiny as opposing views of the world are deconstructed.

Political geography is now a vibrant component of its parent discipline. Its renaissance and expansion were marked by the launch of the journal *Political Geography Quarterly* in 1983, which is now published eight times a year (as *Political Geography*) and is the major source for tracking developments.

## QUANTITATIVE ANALYSIS

Unlike its sister disciplines of economics or political science, political geography has a relatively small amount of published research that contains quantitative analysis. The reasons for the relatively paucity of quantitative work in political geography can be traced to dual trends that have been evident for the past 20 years. First, like the rest of human geography, political geography has seen a rise in interest in poststructuralist and humanistic research methodologies as the 1970s heyday of positivism passed.

Some scholars believe that this trend has acquired because words are more persuasive than numbers, though it seems more likely that political geography is returning to the status quo ante, where quantitative methodology is just one of a plethora of options on the research menu. Second, and connected to the first, quantitative geography (and shortly after, geographic information systems, GIS) was promoted as a response to the challenges of the day, especially the economic stagnation in Western countries. By pursuing spatial analysis and GIS, and later merging these approaches, geography could certify its scientific status and show its various uses.

To paraphrase P. Longley and M. Batty (1996), quantitative political geography now stands at a junction. Either it will be integrated more intensively with the rest of political geography (this has to be a two-way street and will only succeed if non-quantitative political geographers accept quantitative approaches and research results) and more generally with other quantitative social science, or it will become further isolated.

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## Polo, Marco (1254–1324)

MARCO POLO IS THE best known of all Western travelers along the SILK ROAD. He traveled Asia for 24 years, all the way to CHINA, where he became confidant of Kublai Khan (1214–94.) He also wrote of his travels. Marco was born in ITALY, either in Curzola off the Dalmatian coast or in Venice, in 1254. He grew up in Venice, the center of Mediterranean commerce. As befitted the son of nobility, he was educated as a gentleman.

When Marco was six, his father and uncle, merchants of Venice, traveled to Sudak on the Crimea, then to Surai on the Volga River. When civil war broke out, the brothers Polo went to BOKKARA, where they remained for three years. While there, they encountered an ambassador from the Mongol Hulagu Khan. With him they traveled to BEIJING, arriving in 1266. After a year, the brothers returned to Italy with a letter from the Great Khan to Pope Clement IV asking for 100 learned men to teach the Mongols of China about Western ways and religion. Marco accompanied his father and uncle on the next trip to China. Marco was 17. Bearing gifts and letters from Pope Gregory X, the Polos traveled through ARMENIA, Persia, and AFGHANISTAN, over the Pamirs, and all along the Silk Road to China. At Badakhshan, Marco became ill, forcing a year's delay. Once over the Pamirs, the highest place in the world, they crossed the Taklamakan desert. Polo recorded the interesting sights and people. His descriptions were clear and able to generate some sense of the feelings the natural and human wonders he encountered. He noted that although dangerous, the route was well traveled. He also produced a detailed history of the Mongols and the Great Khan. He described life on the STEPPES. He talked of marriage customs and life in general. After the Polos arrived in Shang-tu, the summer capital, Polo began to chronicle China under the Mongol ruler.

As a member of the court and fluent in four languages, Marco Polo traveled to China, Burma, and INDIA, places not seen again by Westerners until the 19th century. He described ceremonies, hunting, and the new capital city. Much of this could be translated into terms easily understood in the West because comparable activities occurred there.

Some things were totally new to him: asbestos, fireproof cloth, paper currency, coal, the imperial post, crocodiles, coconuts. Polo's travels showed him great power and wealth and an extremely complex society. China's economy far surpassed that of all Europe.



China generated 125,000 tons of iron a year, an output not matched until the 18th century in Europe. A canal network linked large cities in a commercial network. Credit was available, as was paper money. The Khan's message system was so efficient that a high-priority message could travel in one day the same distance a lone traveler would cover in 10 days. The level of prosperity was well beyond the wildest European imaginings. Polo even joined the Privy Council in China in 1277. He served as tax inspector in Yanzhou, on the Grand Canal northeast of Nanking.

For 17 years, the Polos remained at the Chinese court. They amassed great stores of gold and jewels. They wanted to be sure they could get their fortunes out of the country before Kublai Khan, then in his late 70s, died. Reluctantly the Khan agreed, and the Polos took two years to get home by sea. In Persia, they learned of the death of Kublai Khan, but his golden tablet of authority still protected its possessors, and they were able to travel through dangerous territory safely. They arrived in Venice in 1295.

In 1298, Polo commanded a galley in the Venetian war against Genoa. Captured, he spent a year in prison. There he met a romance writer, Rustichello of Pisa. Rustichello convinced Marco to dictate *The Description of the World or The Travels of Marco Polo*. Polo's descriptions of China, India, and Africa made his writings one of the most popular books of medieval Europe. Unfortunately, most Europeans referred to it as *Il Milione*, or *The Million Lies*.

With peace in 1299, Polo returned to Venice. He married and had three daughters and remained in Venice until his death at age 70. His deathbed statement was, "I have only told the half of what I saw!" Subsequent scholars wondered about Polo's truthfulness. He didn't mention the Great Wall, nor did he learn Chinese. He ignored common things such as foot binding, calligraphy, and tea. He never became an entry in the Chinese Annals of the Empire, wherein all important visitors were recorded. These discrepancies raise the question of whether or not the Polos actually went to China.

Polo's book retained a strong readership, with hundreds of manuscript editions in the century after his death. It was the most important travelogue of its time, and the most important on the Silk Road ever written in a European language. Eighty manuscript copies of his books in various versions remain extant. Scholars continue to examine and authenticate the travels of Polo. Geographers in the 14th century began using his maps in publications such as the *Catalan World Map*

of 1375, used by Christopher Columbus and Prince Henry the Navigator. His distances were accurate, and he was perhaps the precursor of a scientific geographer. Much was validated by 18th- and 19th-century travelers. Even Chinese historians use his work to better understand the events of their 13th century.

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## Polynesia

POLYNESIA, MEANING "many islands" (Greek), is one of the three main divisions (the others being MICRONESIA and MELANESIA) of Oceania. This division is based upon the ethnological background of the different islands' inhabitants. Geographically, Polynesia is a triangle area of islands, with the Hawaiian Islands at one corner, NEW ZEALAND at another, and EASTER ISLAND forming the third corner, located in the central and South PACIFIC OCEAN. The larger islands are generally volcanic in origin; the smaller ones are generally coral formations. The principal groups are the Hawaiian Islands, SAMOA, TONGA, New Zealand, KIRIBATI islands, COOK ISLANDS, and the islands of FRENCH POLYNESIA. Malayo-Polynesian languages are spoken in Polynesia.

One of the biggest questions concerning Polyne-sians is where did they originally come from and how did they get to the distant islands that comprise what today is known as the Polynesian Triangle? Numerous disciplines have become involved in trying to trace Polynesian origins; among them are geographers, anthropologists, archaeologists, and historians.

One way of trying to determine the settlement issue is to study the various languages and oral traditions of discovery by the numerous Pacific peoples. Other avenues of answering the settlement question include archaeological excavations, including those focusing on a distinctively decorated type of pottery called Lapita, and tracing the origins of the various food staples found in Polynesia.

The earliest descendants of the Polynesians were believed to have started their Eastern trek into the Pacific around 1500 B.C.E. Starting from New Guinea and moving east through the SOLOMON ISLANDS then the VANUATU islands. As the early Polynesians moved farther to the east, the distances between the islands increased from tens of miles, to hundreds of miles, to in some cases over a thousand miles. Superior sailing skills is one of the attributes of the Polynesians that allowed them to traverse such great distances and unfavorable conditions to settle the various islands groups that make up Polynesia.

The Polynesia sailing craft was an early catamaran consisting of a double canoe made of two hulls connected by lashed crossbeams. This served two purposes: the first was that the design provided stability and the second was that it increased the capacity to carry large loads. The hulls were large enough to carry all their supplies and equipment. The central platform created over the crossbeams provided working, living, and additional storage space for the seafarers. Sails made of woven matting powered the ships, which were by long paddles enabling them to keep on course.

The canoes were generally 49 to 65 ft (15 to 20 m) in length and could carry 20 people with all of their supplies needed to colonize newly discovered islands. Among the supplies carried on these crafts were domesticated animals (pig, dog, and chicken) and planting materials to begin new cultivations at their homes: sweet potato, taro, bananas, yams, breadfruit, and sugarcane. They developed a portable agricultural system to compensate for the decreased flora and fauna they found on the new islands. The Polynesian navigation system was based on star observations, ocean swells and currents, and the flight patterns of birds along with other natural signs to find their way across the great ocean open distances they traversed.

Polynesia today is a mix of political and economic systems reflecting the large area that it covers. Most of the island groups have their own sovereignty, while others are either under the administration of or have special relations with foreign countries: French Polynesia with France, and Cook Islands, NIUE, and Tokelau with New Zealand. The Hawaiian Islands became the 50th state admitted to the UNITED STATES in 1959. The economies of the various islands are also varied. Tourism plays a very large part in the economies of all the island groups in Polynesia. But because of their small geographic size, natural resource exploitation is generally limited to specialized agriculture and fisheries. A large number of Polynesians make their home

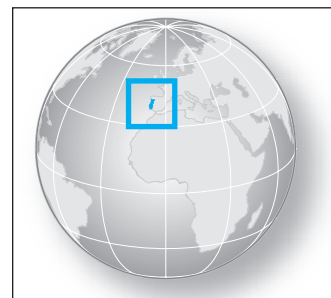
in Auckland, New Zealand, which is the largest Polynesian city in the world.

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## Portugal

**Map Page** 1131 **Area** 35,672 square mi (92,391 square km) **Population** 10,102,022 **Capital** Lisbon **Highest Point** Pico 7,713 ft (2,351 m) **Lowest Point** 0 m **GDP per capita** \$15,000 **Primary Natural Resources** forests, cork, marble, fisheries.



THE PORTUGUESE REPUBLIC is located in southwestern Europe, sharing the Iberian Peninsula with SPAIN, which it borders to the north and east. To the west and south it borders the ATLANTIC OCEAN. Portugal is a parliamentary democracy. The prime minister leads the government and the president is the chief of state. The capital and largest city is LISBON (Lisboa).

The country is organized in 18 districts in the mainland and two Autonomous Regions, the archipelagos of Madeira and AZORES (Açores), located in the North Atlantic Ocean. The state is highly centralized, with only the autonomous regions enjoying a high degree of self-governance. Recently, a more geographic division comprising 5 major regions and 28 minor ones was designed and utilized for statistical purposes.

The area that became the country of Portugal has had a varied human presence since prehistoric times, in part because of its position as the crossroads between the MEDITERRANEAN SEA and northern Europe and the fact that several natural harbors existed along the coast. Settlers included Phoenicians, Carthaginians, Lusitanians, Romans, Suevi, and Visigoths, among others. Roman and Muslim influences endured, especially in the south of Portugal. The country's name seems to have originated from the Roman designation of the area around Porto as Portus Cale (Port of Cale). Mus-

lims from North Africa invaded the peninsula in 711 C.E., sparking a crusade effort by Christians that originated several kingdoms and feudal holdings in the area.

In 1143, Afonso Henriques (Afonso I) obtained independence from the kingdom of Castile and León and became the first king of Portugal, then confined to the area between the Douro and Minho rivers. He proceeded with the reconquest from the Moors southward, seizing Lisbon in 1147, and the coast of Algarve was reached in 1250. The Portuguese borders have remained almost unchanged since 1297.

Cornered in one extreme of Europe and motivated by the will to find a sea route to coveted Asian goods while spreading Christianity, Portugal turned to the sea from the beginning of the 15th century. It first occupied the stronghold of Ceuta (1415), then discovered Madeira (1419), and, supported by the vision of Prince Henry the Navigator, launched the Age of Discoveries that would allow the European expansion into new worlds and shift commerce to the Atlantic.

Portuguese mariners sailed south along the African coast on the way to INDIA and in 1500 claimed the lands that became BRAZIL. The country obtained great economic, political, and cultural influence during the 15th and 16th centuries, culminating its expansionist period with colonies in Africa, Asia, and South America.

In the 1600s and 1700s, Portugal faced increasing competition from other European nations, and lost much of its power with the Napoleonic wars and the independence of Brazil (1822).

After deposing the monarchy in 1910, the country experienced an unstable and short-lived republicanism. In 1926, a military coup initiated a long period of repressive fascist dictatorship, during which the country stagnated and grew more isolated from the world, leading many Portuguese to emigrate. Portugal lost the colony of Goa to India in 1961, and a war for independence erupted in the African province of ANGOLA, soon spreading to the colonies of MOZAMBIQUE and GUINEA-BISSAU.

In 1974, a peaceful military-led revolution reinstated democracy, and the following year Portugal granted independence to its five African possessions, triggering the return of many Portuguese settlers and an influx of immigrants. In 1999, the country's imperial age would finally come to a close, when Macao, the last colonial holding, was returned to China. As if to seal its return to the European boundaries, Portugal became a member of the EUROPEAN UNION in 1986 and

was in the first group of countries adopting the euro as official currency in 2002.

## LAND AND RESOURCES

Despite its modest dimensions (roughly 342 by 124 mi or 550 by 200 km), mainland Portugal displays surprising physical diversity. The territory is situated on the edge of the Mediterranean basin, bordering the Atlantic Ocean, in the Subtropical Zone of the Northern Hemisphere. This transition area experiences both Atlantic and Mediterranean influences with expression in the climate and in the vegetation. Differences result mainly from the combination of latitude, elevation, and distance to the large Atlantic Ocean, as demonstrated by the complex plant cover. The main limiting factor of the natural vegetation is the irregular precipitation on account of latitude, and botanical domains have organized mostly from north to south.

The climate is maritime temperate (cool, rainy) in the northwest and markedly Mediterranean (warmer, drier) in the south. The northeast suffers similar hot and dry summers but has colder winters. On an average year, Porto receives 50 in (128 cm) of rain, and Lisbon 31 in (78 cm), with some areas in the southeast receiving less than 12 in (30 cm). A few mountainous areas get limited amounts of snow. The main climatic features of Portugal are summer drought and the irregular precipitation, with sequences of dry and wet years alternating frequently. Along the west seaboard, a steady wind blows from the northwest on typical summer afternoons, in response to a pronounced coastal upwelling effect. This process keeps the sea water cool year-round.

In Portugal, the natural conditions also combined with a long human presence to produce diverse landscapes, where native and many introduced plant species coexist. The former provincial division has some geographical meaning and is still used to designate the different regions.

Mainland Portugal sits mostly to the west of the large platform that dominates the center of the Peninsula, called Meseta. The area suffered major tectonic activity during the Miocene era: It was more intense in the north, where the main mountain ranges are found. This activity also originated the Central Range, rising from the southwest to the northeast and culminating in the Serra da Estrela, with the highest elevation of peninsular Portugal (6,539 ft or 1,993 m). The rivers flowing to the west from the interior of the peninsula have cut deep valleys through the western mountains on their way to the ocean. Main rivers, including the

Tagus (Tejo), Douro, Minho, and Guadiana, have their sources in Spain and are heavily dammed, generating some dispute for the water between the two countries.

To the south of this core of older rocks, the basins of the rivers Tagus and Sado filled with sediments during the tertiary Era. Two platforms, starting to form 200 million years ago, spread to the west of the Central Range and along the southern coast of Algarve.

The Portuguese coastline stretches for about 517 mi (832 km). The coast is generally straight and sandy north of Peniche, interrupted by a few rocky capes. In some places it is indented by river estuaries and shallow saltwater lagoons. The broad estuaries of the Tagus and Sado provide good natural harbors, utilized as such since ancient times. The southwest has rocky shores interrupted by sandy beaches.

The Central Range is usually considered the main division between the mountainous north and the south, characterized by rolling plains and a few scattered small ranges.

In the northwest region of Minho, the ranges of granite mountains facing the ocean receive more than 79 in (200 cm) yearly and are the source of the rivers Lima, Cávado, and Ave. The flat coastal areas and river valleys are intensively cultivated, typically with corn fields or pastures surrounded by vines, and dairy farms are common. This green region has the highest population density of Portugal, with numerous villages and houses dispersed along the roads.

### RAIN SHADOW

East of the mountains and experiencing a rain shadow effect, the drier northeast is basically a series of plateaus interrupted by valleys. Some of the broader ones are rich agricultural areas, as in Chaves and Vilarica. Isolated villages are surrounded by orchards, vineyards, and grain fields.

In part due to the pronounced summer drought, this region of Trás-os-Montes displays some similarities to the south of the country, with cork oak trees dotting the wide landscapes. Marking the oriental border with Spain, the Douro River runs for 62 mi (100 km) inside a rocky canyon before entering the deep, large valley, where port wine has been made since the 1700s. For thousands of acres on both sides of the river, the slopes were terraced by human hand to sustain the vineyards, in an endeavor of daunting proportions.

South of the Douro, the central region of Portugal is mostly mountainous, with forests covering the lower slopes and sheep and goats grazing at higher eleva-

tions. These mountains are the source of important water courses, such as the Zêzere and the Mondego, the latter is the longest river whose source is in Portugal.

People have initially settled along these river valleys, and some towns in the interior regions of Beira Baixa and Beira Alta are still walled or protected by castles, attesting the wars once opposing Iberian kingdoms. In the Beira Litoral, closer to the ocean, crops occupy the flat lower river valleys, and forests of pine trees now cover ancient coastal dunes.

### ESTREMADURA

In the hilly region of Estremadura, north of Lisbon, the varied agriculture includes grain, orchards, vineyards, and vegetables to supply the metro area. To the west of the capital city, the humid Serra de Sintra stands out as an island of lush vegetation protected by old palaces and fortresses. South of the 621-mi- (1,000-km-) long Tagus River spreads the savannalike landscape (called *montado*) of the Alentejo, where wheat fields or cattle pastures are punctuated by cork oak trees. The declining population concentrates in settlements of low white houses. Part of the wild coast, with small beaches between rocky cliffs, is protected as a natural park.

The wooded mountains of the Serra de Monchique and Serra do Caldeirão separate the rolling plains from the southernmost region of Algarve. Here, the land slopes gently toward the calm ocean, with orchards and greenhouses for growing vegetables occupying the lower reaches. Along the coast, fishing gave way to tourism as the main activity, with villages becoming summer resorts and golf courses replacing cropland.

### AZORES AND MADEIRA

The archipelagos of the Azores and Madeira have a volcanic origin and were both discovered and settled in the 1400s. The nine islands of the Azores occupy 896 square mi (2,322 sq km) and have 241,763 inhabitants (2001). The archipelago straddles the MID-ATLANTIC RIDGE and displays secondary forms of volcanism, such as geysers and fumaroles. The rainy climate and fertile soil allows for agricultural use and presence of lush vegetation cover.

Located 560 mi (900 km) southwest of Lisbon, off the coast of North Africa, the autonomous region of Madeira occupies 303 square mi (785 sq km) and has a population totaling 245,000 (2001). The archipelago includes the namesake island, as well as Porto Santo and two uninhabited group of islets, the Desertas and the Selvagens. The landscape of Madeira, the main is-



land, is heavily eroded, with the mountainous interior revealing deep valleys amid jagged peaks. Fishing villages dot the rugged and rocky coast, almost devoid of sand. A rare and primitive type of forest dating from pre-glacial times occupies the intermediate elevations, giving way to pastures above that. A complex system of canals, called levadas, allows the watering of cereals and vegetables grown at lower elevations and on terraced slopes.

The climate is mild year-round with a mediterranean tone, enabling the presence of semi-tropical vegetation and production of sugarcane and bananas for export. Wine is also a hallmark product of the island, originating from the vineyards that cover the southern slopes. The area around Funchal, the main city, concentrates 70 percent of the population and the chief economic activities. The city is an important port of call for transatlantic cruises, and tourism is a major source of revenue. However, a long history of emigration still causes the population of Madeira to decrease.

Portugal has scarce natural resources, and is heavily dependent on imported fossil fuels. Hydropower accounts for 30 percent of the energetic needs, with the rest coming from coal-based power plants. Use of other renewable sources is slowly increasing. Mining included coal, gold, uranium, wolframite, and copper, but activity has been declining. The south has large reserves of copper and zinc still in exploitation, as well as marble quarries.

## AGRICULTURE

The combination of poor soil and Mediterranean climate results unfavorable for intensive agriculture in Portugal. The soils tend to be rocky or sandy, with the exception of fertile alluvial plains, notably along the lower Tagus. Olives, vineyards, and orchards remain important permanent crops, despite the recent increase in irrigated agriculture. Agriculture, forestry and fishing employ 13 percent of the workforce and create 4% of the GDP. Main agricultural products include wine, tomatoes, corn, potatoes, wheat, olives and olive oil, fruits, grapes, beef, and dairy products. Animal production also includes hogs, sheep, and goats. Farms are generally small, but diverse types of land ownership have contributed to differences in farm structure.

Forests cover about one-third of Portugal, but wildfires are a recurrent hazard in the summer, due to drought caused by the mediterranean climate: 1,047,700 acres (424,000 hectares) burned in 2003, the worst year on record. Oak and chestnut trees characterize the north, while pine occupies in the north and

center. Introduced for wood pulp production, the eucalyptus has rapidly expanded in the last 20 years. In the south, the cork oak has great economic importance, with Portugal being the leading world producer of this material. Natural shrubs also cover large areas, with mediterranean-type maquis dominating in the drier south.

Portugal has the largest EEZ (exclusive economic zone) of the European Union (617,775 square mi or 1,600,000 square km), but the sea is under-exploited. Commercial fishing is in decline, yet the Portuguese remain important consumers of seafood. Aveiro, Lisbon, Leixões (Porto), and Peniche are major fishing ports.

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## prairie

BEFORE NORTH AMERICA was populated by settlers who developed the land, most of the continent was covered by flat grass-covered areas known as prairie, stretching from CANADA to MEXICO. By the beginning of the 21st century, 99 percent of the original prairie had been destroyed. The provinces of Alberta, Saskatchewan, Manitoba, and Ontario are part of Canada's prairie. In the UNITED STATES, prairies are found in NORTH and SOUTH DAKOTA, MINNESOTA, NEBRASKA, IOWA, ILLINOIS, INDIANA, WISCONSIN, KANSAS, MISSOURI, OKLAHOMA, and TEXAS. In South America, prairie land is known as PAMPAS. In Africa, it is called veldt; and in Asia, it is known as STEPPE.

Some 60 different species of grass once could be found among North American prairies. Growth potential seemed almost unlimited because prairie grasses were able to adapt to weather that varied from extreme hot to extreme cold. Prairie grass extended rapidly since it was pollinated by the wind.

Prairie grasses are classified as tall-grass, mixed-grass, short-grass, bunch-grass, mesquite, and tree. The kinds of prairie grass found in an area are dependent on a number of variables, including weather, longitude, latitude, extent of usage, soils, and landforms. Typically, grasses become shorter as the prairie progresses from east to west. Prairie grasses range from eight-foot-tall grasses, such as bluestem, switch grass, and slough grass, to one-half-foot short grasses, such as blue grama, hairy grama, and buffalo grass. Of the six types of prairie grass, tall-grass and mixed-grass regions are the most productive agriculturally. America's wheat belt, which grows abundant amounts of corn, wheat, barley, oats, and rye, is home to such prairie grasses.

The area that extends from southern Manitoba to Missouri to Wisconsin to Illinois to Indiana to Oklahoma and Texas is known as True Prairie. While prairies tend to be relatively flat, knolls, steep bluffs, hills, valleys, and alluvial floodplains exist in this area.

Rainfall varies from one prairie section to another. Southern prairies tend to be dry and hot, with numerous shrubs. In the north, prairies are cool and humid. Some 70 percent of all precipitation in the western prairie falls during the growing season.

In the area that extends from Oklahoma to Illinois, for instance, the prairie receives around 40 in (101 cm) of rain each year. In the northeastern section that reaches from Minnesota to Manitoba, some 23 in (58 cm) fall in a given year. Oklahoma prairies may experience as much as 30 in (76 cm) a year, while Nebraska and North Dakota receive 25 in (63 cm) and 20 in (51 cm) per year, respectively. Droughts may occur in the prairies in the summer and fall, making the area vulnerable to fire. Prairie soil and chernozem soil dominate the plains. Both of these dark soils tend to be rich in humus and conducive to plant production.

One prairie area designated as the High Plains stretches from Alberta, Saskatchewan, in Canada to Montana and North Dakota in the United States. Generally flat in the eastern section, the High Plains rise around 10 feet per mile as they reach the foothills of the ROCKY MOUNTAINS. Since much of this land remains uninhabited, pronghorn antelope and mule deer are still abundant. With average rainfall of less than 20 in (50 cm) per year, the short-grass, which is mostly blue and grama, in the High Plains is too dry to provide irrigation for crops or grazing for livestock. The area's river valleys, coulees, and ravines are too steep for farming and are too bare for logging. Taller and thicker grass populates the eastern section of the High Plains,

and forbs, which are broad-leaved, flowering shrubs, are plentiful. Riverbeds and wetlands, with numerous lakes, marshes, sloughs, and potholes provide homes for most of the wildlife remaining in the area.

Originally, large animals found in the prairie included American bison, pronghorn antelope, mule deer, white-tailed deer, elk, lynx, grizzly bear, bobcat, fox, cougar, prairie wolf, and coyote. Jackrabbit, cottontail, mice, weasel, badger, prairie dog, shrew, vole, ground squirrel, gopher, skunk, and raccoon were among the smaller animals found in the area. Bird life on the prairies was abundant, including bobolink, pipits, meadowlark, sparrow, grouse, prairie chicken, hawk, eagle, falcon, and vultures. Pelican, crane, heron, sandpiper, swan, geese, and duck were plentiful in prairie marshes. Only small numbers of the original wildlife remain in the prairie. Buffalo, for instance, are now found only on protected reserves.

Despite their sturdy nature, prairies were vulnerable to land development because most immigrants possessed little knowledge of grasslands. Native Americans also frequently destroyed prairie lands to facilitate travel and provide greater security. Fire has also historically presented a major threat to prairies. In the 1930s, prairie recovery efforts emerged, leading to an increased interest among environmentalists, ecologists, and others interested in preserving the integrity of native prairie grasses.

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## precipitation

PRECIPITATION IS WATER falling from clouds. In the tropics, rain is the common form. In colder climates, precipitation also falls as snow, sleet, or hail, if

the air temperature is 32 degrees F (0 degrees C) or less. Water's descent from clouds begins when the size of water droplets or ice crystals becomes large enough for gravity to pull them toward Earth's surface. Precipitation occurs because humid air rises, expands, and cools to form clouds with sufficient moisture to cause a storm. Precipitation will not occur unless there is ample water vapor in surface air, enough air rising from the surface, and sufficient condensation nuclei.

Water vapor is the source of precipitation and bearer of energy that drives storms. The bulk of this vital gas enters the atmosphere when solar energy heats and evaporates surface water and when plants transpire water through leaves. The change of water from a liquid to a gas requires energy that resulting water vapor holds on to, storing it in air as latent heat of vaporization. Latent energy is nonsensible, meaning neither human skin nor a thermometer can detect it. However, this seemingly trivial energy converts to sensible heat when condensation takes place in clouds. As we shall see, this heat (heat of condensation) is the energy that gives birth to storms of all types, including hurricanes and tornadoes.

Condensation occurs because moist air rises, expands, and cools, diminishing the air's capacity to hold water vapor. Condensation starts when air temperature falls below the dew point (the temperature at which air is unable to hold all its water in vapor form). Water vapor collects (condenses) around tiny solid particles (condensation nuclei) to form visible water droplets. The tiny droplets are the beginnings of a cloud.

### LIBERATED HEAT

A cloud grows as condensation liberates water vapor's latent energy as heat of condensation. The liberated heat keeps air inside the cloud warmer (and therefore less dense and lighter) than the surrounding air. The warm temperature buoys airlifting inside the cloud and continues condensation and heating by drawing more moisture-laden surface air into the cloud. The circular process of lifting, expansion, cooling, condensation, heat release, and more lifting promotes precipitation. Precipitation stops when moist surface air stops lifting into the cloud.

The principal cause of precipitation is upward movement of moist air resulting from convective, frontal, orographic, and cyclonic (convergent) lifting. Each type of lifting produces a characteristic type of precipitation.

Convective lifting starts when air over a hot surface warms, becomes lighter than the surrounding air, and

rises. Cooler surface air then moves in over the hot surface, warms and lifts as well. Airlifting continues as long as surface heating warms air to a temperature that is higher than that of the surrounding air. Convective precipitation occurs mainly in equatorial and tropical regions and in summer in middle latitudes. The hot summer afternoon thunderstorm, which generates heavy precipitation, thunder, and lightning, is precipitation of this type.

Frontal lifting occurs along boundaries between relatively cold and warm air masses. Meteorologists call these boundaries fronts. Lifting along fronts occurs mainly in the middle latitudes (about 35 degrees to 55 degrees) where polar and subtropical air masses typically meet. The physical basis of frontal lifting is that the cold polar air is denser and of a higher pressure than warm subtropical air, so that the cold air tends to hug Earth's surface and the warm air tends to lift relatively easy. Frontal lifting causes precipitation in two ways: (1) a wedge of cold surface air moves against adjoining warm (lightweight) air to form a cold front; and (2) a warm surface wind overtakes and ascends above the edge of a cold air mass to develop a warm front.

Orographic lifting takes place when a mountain barrier forces a warm, moist wind to rise. Precipitation takes place over the windward (upwind) side of a mountain, as the barrier forces the flowing air to rise, expand, and cool there. Precipitation ceases when the air descends the leeward side, as cooling by expansion ceases. Orographic lifting causes rain shadows (areas of scant precipitation) on leeward (downwind) sides of mountains if moisture-bearing winds come from only one direction during the year. The rain shadow effect is more obvious on western sides of continents in middle latitudes, where mountains block moisture-laden westerlies from oceans from entering leeward areas.

Cyclonic or convergent lifting describes airlifting in two types of storms—extratropical and tropical cyclones. The lifting results from widespread convergence of surface winds toward a low pressure. Moist winds converge in a circular pattern into the center of the low pressure where air is rising in a signature cyclonic spiral. In the Northern Hemisphere, the wind direction is counterclockwise and in the Southern Hemisphere, it is clockwise.

In an extratropical cyclone, the lifting trigger is a small meander in the polar front JET STREAM, a high-speed wind that flows above the front. The jet stream's meander forces upper air to descend and surface air to rise in close proximity. The two resulting surface

fronts—cold front and warm front, respectively—join to form the low-pressure center. The storm grows as cold and warm surface winds converge from all directions toward the center. Meteorologists call this type of storm an extratropical cyclone (or middle latitude cyclone) to distinguish it from a low latitude tropical cyclone, which involves convective (not frontal) lifting.

The tropical cyclone forms over hot tropical oceans as prodigious amounts of heat and moisture transfer into the air. Precipitation begins as a disorganized cluster of relatively small convective thunderstorms. A low surface pressure center develops to centralize the inflow of energy into a rainy tropical depression. Moist air of converging winds lifts, cools, creates dark, moisture-laden clouds, and feeds a massive tropical storm. If wind speeds exceed 73 miles per hour (116 km per hour), the storm is officially a hurricane.

### GEOGRAPHICAL DISTRIBUTION

The general occurrence of precipitation in the tropics conforms to latitude. The equatorial zone (roughly latitudes 0 degrees to 10 degrees) receives more precipitation than any other latitudinal zone on Earth; surface heating and convection brought on by the sun's direct rays is the lifting mechanism. The Intertropical Convergence Zone (ITCZ)—an area of convective lifting into which moist trade winds converge—dominates equatorial precipitation. The ITCZ shifts back and forth across the equator as it follows the seasonal path of the sun's most direct rays. The shifts bring precipitation to the equatorial zone all year.

On poleward edges of the ITCZ (about latitudes 10 degrees to 15 degrees), annual precipitation levels drop off rapidly, as convective showers occur only in the summer. A dry winter is due to the invasion of high-pressure air masses, whose source areas are the subtropics (about latitudes 20 degrees to 35 degrees). The subtropical highs result from descending air, which limits cloud formation. Consequently, the world's greatest deserts are located in subtropical latitudes. Major exceptions to dryness in the subtropics are in Southeast Asia and the Himalayas. In these areas, summer (convective) monsoon showers in combination with orographic lifting bring extremely high levels of precipitation to about 20 degrees N and 30 degrees N, respectively.

The middle latitudes (from about 30 degrees to 60 degrees ) have a more complex spatial pattern of precipitation than that of the tropics. Generally, coastal areas are more humid than interior areas, because of onshore flow of marine air. A major exception is severe

summer dryness on west coasts between latitudes 30 degrees and 40 degrees. Subtropical high-pressure curbs airlifting there in the summer. In contrast, high amounts of precipitation on west coasts between latitudes 40 degrees to 60 degrees occur because of lifting by of the westerlies by frontal, cyclonic and orographic means. Mountain barriers contribute to rain shadow areas (giving rise to DESERTS) in interiors of North America and Asia. In Europe, open terrain allows westward moving extratropical cyclones greater access to the continental interior. The eastern section of continents in the middle latitudes tends to be humid, as precipitation comes from weather fronts and extratropical cyclones in fall, winter, and spring, and convective showers and weak cold fronts in summer. Tropical cyclones or their remnants add to precipitation totals in the eastern section in the summer and fall.

Cold, dry air masses dominate polar and arctic latitudes (from about 60 degrees to 90 degrees) all year. Precipitation amounts are comparable to those in subtropical deserts. Airlifting is ineffective in generating much precipitation because the region's low temperatures suppress evaporation levels. Cold air subsidence also lessens chances of precipitation occurring. Lower latitudes of this zone receive most of the precipitation, as occluded parts of extratropical cyclones brush the equatorward fringe the year round.

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## projection, maps

THE EARTH CAN BE assumed as a perfect sphere for purposes of simplicity. However, in reality there is a large difference between the pole-to-pole distance and the equator distance. The Earth is about 1/300th smaller in its pole to pole distance. This unique shape



is called an oblate ellipsoid or spheroid. An estimate of the ellipsoid allows calculation of every point on the Earth, including sea level, and is often called the datum. With time and in different countries many datum have been established.

The current U.S. datum most commonly used is the World Geodetic System 1984 (WGS 84). Map projections are used to transfer the spherical location information on a datum or ellipsoid onto a flat surface. The transformation process always results in distortions in shape, distance, direction, scale, and area. Projections minimize distortions in some of these map properties but at the expense of increasing errors in other properties. Conformal maps preserve shape, as the scale of the map from any point is the same in any direction. Scale is defined as the relation between distances on the map and the same distance on the Earth's surface. Direction is preserved when azimuths (angles from a point on a line to another point) are correct.

In the spherical coordinate system, the Earth is considered to be composed of longitude lines (meridians), which run north-south, and latitude lines (parallels), which run east and west. The longitude lines converge at the North Pole in the Northern Hemisphere and at the South Pole in the Southern Hemisphere. All meridians and the equator are great circles since they can form planes that cut the surface and pass through the center of the Earth. Small circles, such as latitude lines, form a plane that cuts the surface but does not pass through the centre of the Earth.

In this system of reference, geographic coordinates are measured in units of angular degrees. There are 360 degrees of longitude around the equator, with each meridian numbered from 0 to 180 degrees east and west such that the 180 degree meridian is on the opposite side of the Earth from Greenwich. There are 180 degrees of latitude from pole to pole, with the equator being 0 degrees and the north and south poles being 90 degrees.

Each degree can be divided into 60 minutes and each minute is divided into 60 seconds. The north-south line is called the prime meridian, which has been arbitrarily set to pass through the Royal Observatory in Greenwich, England. The longitude is measured as the angle between the point, the center of the Earth, and the prime meridian at the same latitude. West is positive and east is negative, meeting at 180 degrees at the international date line. The east-west line follows the equator and is midway between the north and south poles. Degrees of latitude are measured as the angle between the point on the surface, the center of

the Earth, and a point on the equator at the same longitude.

Other coordinate systems are based on a flat surface. The easiest way to try to transfer the information to a flat surface is to convert the curved Earth locations into an X and Y coordinate system, where X corresponds to longitude and Y to latitude. In order to clarify understanding, the transformation process can be considered as a two-stage process. In the first stage, assume that the Earth has been mapped on a reduced size globe that will produce a flat map of a desired size when unfolded.

In the second stage, each point on the surface of the globe is transferred onto a flat surface. The transformation is usually in the form of mathematical functions and the points are "projected" onto one of three flat surfaces, which can then be unfolded into a chart. The three surfaces are a cylinder, cone, and plane. The lines formed by the latitude and longitude on a map are called the graticule. Latitude or longitude lines where the projection surface and location information about the Earth intersect is called the point of contact or standard line. Distortion is minimized nearest to the standard line. A graphical representation called the Tissot Indicatrix is commonly used to visualize the angular and area distortions that occur across the flat map surface because of the transformation process.

A cylindrical projection places the Earth inside a cylinder with the equator touching the inside of the cylinder. Cylindrical projections are mostly used for areas near the equator. If the axis of the cylinder is placed perpendicular to the axis of the Earth, the resulting projection is called a transverse projection. A cone is placed over the Earth to produce a conic projection. A conic projection is best for middle latitudes. An azimuthal projection places a plane over a point on the Earth. The azimuthal projection is used for polar charts because of distortions at other latitudes.

Map projection affect the distance, area and shape, and angle relationships of the Earth features as displayed on the flat map. Equal area projections preserve the property of area. Maps with an equivalent projection show all parts of the Earth's surface with the correct area. However distances along the latitudes are not accurate. Conformal projections preserve the property of shape over small areas. Conformal projections are valuable since they preserve directions around any given point. Moreover, angles relationships within the graticule are shown correctly. Area and shape are normally distorted. Some projections only preserve correct distance relationships along a few places on the map.

There may also be compromise map projections. These may be the average of two or more projections in order to minimize distortion. Some examples of the projections mentioned above are Mercator (conformal projection, preserves shape), Lambert Equal Area (equidistant projection, preserves areas), and Robinson (compromise projection, limits area and angle distortion).

When the three-dimensional Earth is projected onto a flat paper map, there are distortions in distance, area, and direction, and the projection process attempts to minimize these distortions when transferring the curved Earth to the flat paper map. On the flat map there is no natural reference point, but one can be defined using an arbitrary system of coordinates. A grid of intersecting parallel and perpendicular lines is placed over the projected map such that the origin of the grid lines falls on a point of interest on the map. This arrangement is called a grid reference system and every point on the flat map can be located with a unique X and Y coordinate. Usually the X coordinates are referred to as “eastings” and the Y coordinate as “northings.”

An example of a grid coordinate system is the Universal Transverse Mercator (UTM) system. The UTM coordinate system is commonly used in geographic information systems because the United States Geologic Survey (USGS) topographic maps use the UTM system. The UTM projection is formed by using a transverse cylindrical projection (the standard line is a line of longitude). The result is to minimize distortion in a narrow strip running pole to pole. UTM divides the Earth into pole-to-pole zones 6 degrees of longitude wide. The first zone starts at the international date line (180 degrees east) and the last zone, 60, starts at 174 degrees east. Northings are determined separately for the areas north and south of the equator. The Southern Hemisphere uses the South Pole, while the Northern Hemisphere uses the equator. Distortion is extreme at high latitudes and so UTM is not normally used above 80 degrees north or south.

Maps provide useful and concise spatial information in a meaningful manner, and we use them directly or indirectly in many aspects of our daily lives. Navigating the roadways, finding new places, or just reflecting on the aesthetics of the map are some examples of how we use maps. Maps are also used as a means for storing data, as a spatial index for labeling features or integrating multiple map sheets, and as a spatial data analysis tool for planning and decision-making. A simple but powerful analysis tool is the map overlay

process developed by Ian McHarg in which multiple map layers each on transparent film are overlaid to identify regions of interest.

Understanding projections is especially significant as the concept holds a central position in the design and development of new and emerging spatial technologies such as geographic information systems, remote sensing, and global positioning systems. These technologies provide multiple options to covert among projections. Selecting the correct projection to use must begin with a clearly defined project goal. Thereafter a projection should be selected that has a standard line centered on the geographic region of interest. An assessment of the importance of correct representations of area, angle relations, and distances must also be made. Given these criteria, an appropriate projection for the mapping project can be selected.

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## Ptolemy

KLAUDIOS PTOLEMAIOS, known as Ptolemy in English, lived in Alexandria, EGYPT, in the second century C.E. He is considered one of the most important scientists of the later Classical era, with two major treatises in the areas of astronomy and geography. His geocentric model of the universe was the standard accepted view of the cosmos in Europe until the 16th century. He is also credited with the system of assigning systematic coordinates to geographic features on a map using lines of longitude and latitude.

Very little is known about the life of Ptolemy, except that he made astronomical observations in Alexandria between 127 and 141 C.E. Alexandria was the leading city for scientific scholarship in the 2nd century. Ptolemy's works were written in Greek, the

standard scientific language of the day, but were lost to Europeans after the fall of the Roman Empire, and rediscovered in Arabic translation only in the 12th century. For this reason, Ptolemy's most significant work is known by its Arabic name, the *Almagest*, a rough translation of the original Greek title, *Hè Megalè Syntaxis*, or *The Great Treatise*. The *Almagest* is composed of 13 books, compiling the astronomical knowledge of the ancient Greek and Babylonian worlds. The text includes observations of the stars and planetary orbits that are based largely on the work of Hipparchus from three centuries before. Ptolemy was innovative, however, in creating a mathematical system that explained the movement of the sun, moon and planets around the Earth.

This geocentric (Earth-centered) universe had been proposed since the days of Aristotle, but astronomers had been unable to show mathematically how it worked. The Ptolemaic system used three basic geometric constructions—the eccentric, the epicycle, and the equant—to explain the otherwise erratic movement of the celestial bodies. Epicycles, for example, were small circles that revolved around a larger circle, and made sense of the observed orbital peculiarities of the planets Mars and Jupiter, which seemed at times to slow down, stop, and even reverse direction in their course across the sky. This system was adapted by scholars in the Islamic world and added to for centuries before it was reintroduced in the West. It wasn't until the work of Copernicus and Brahe in the 16th century that the fundamental errors of the Ptolemaic system were exposed, and although geocentrism was rejected overwhelmingly in favor of heliocentrism (a sun-centered universe), nevertheless, the mathematics behind Ptolemy's work continued to be praised as a model of sophisticated classical scholarship.

Ptolemy's second major work is the *Geography*, which was also a compilation of the geographical knowledge of the known world of his time. The *Geography* also gave instructions on how to create maps and discussed mathematical projections, or how to plot a spherical object onto a flat plane. For his maps of the known world, Ptolemy assigned coordinates to all features based on lines of LATITUDE AND LONGITUDE. For latitude, he based his calculations on the length of the midsummer day as it increases from south to north. For longitude, he assigned the number zero for the point furthest west that he knew of, the CANARY ISLANDS, in the ATLANTIC OCEAN, then plotted his lines as far east as CHINA, covering 180 degrees. Ptolemy was aware that he knew only about a quarter of the globe,

but his calculations for the globe's total circumference were off by a sixth. This mistake and mistakes made in the *Almagest* regarding the length of the solar year (he was off by 28 hours, a significant error for a mathematician of Ptolemy's stature) have led some recent scholars to question whether Ptolemy was actually the man responsible for the system that bears his name.

Other works demonstrated the breadth of Ptolemy's scholarship. The *Optics* analyzes reflection and refraction of light on flat and spherical mirrors. His innovation here was the first known mathematical relationship between the angles of rays of refracted light and incident light. *Harmonics* is one of the earliest books on music theory, discussing how different notes are produced by lengthening and shortening of a vibrating string. The *Tetrabiblos* (*Four Books*) was meant as an accompaniment to the *Almagest*, to explain how the movement of the planets affected a person's daily life. It was therefore one of the foundations of Western astrology, which, until recently was firmly intertwined with the science of astronomy.

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## Puerto Rico

THE ESTADO LIBRE Asociado de Puerto Rico is a densely populated island in the eastern Greater Antilles in the CARIBBEAN SEA, divided into 78 counties. Even though it is a possession of the UNITED STATES, Puerto Rico is an independent commonwealth and has self-governance in all its local affairs. The rectangular-shaped, mostly mountainous volcanic island is approximately 100 mi (160 km) east to west and 35 mi (56 km), north to south and has a total land area of 3,515 square mi (9,103 square km). Four other satellite islands—Mona, Desecheo, Culebra, and Vieques—are also under its control. Puerto Rico's warm and humid

tropical weather varies little throughout the year and is often interrupted by hurricane season from June to November. San Juan, its largest and oldest city, is also its capital. Other large cities include Ponce, Mayaguez, and Caguas. The 2004 estimated population was 3,898,000.

Boriquen was the name given for Puerto Rico by its primary inhabitants, the Taino, at the time Christopher Columbus discovered the island in 1493. The Spanish, in search of gold and resources, eventually wiped out the natives by disease, war, and slavery. In 1511, Puerto Rico became the first Spanish colony in the New World and was attacked periodically by the British and Dutch. Many African slaves later arrived to work on the sugar plantations. The island remained in Spanish hands until after the Spanish American War, when it became part of the United States. Today, there is an ongoing debate between gaining complete independence, keeping its commonwealth status, or becoming the 51st state.

Puerto Rico has a very distinctive and mixed culture, influenced by its Taino, Spanish, African, and American heritages. Approximately 80 percent of the population is white, 8 percent African, and 12 percent mixed or other ethnicities. Both Spanish and English are spoken, and the majority of the population is Roman Catholic.

The island's varied topography can be divided into four main regions. Much of the interior of the island is covered by the Cordillera Central, the central mountain range, which contains the island's highest point, Cerro de Punta at 4,390 ft (1,338 m), and El Yunque rainforest, also known as Caribbean National Forest. On the north part of the island is an area of foothills called the Karst Country, made up of beautiful limestone rock formations and underground rivers. On the southwest corner of Puerto Rico is a region of coastal dry forest, made up of desert trees, cacti, bedrock, and many migratory birds, that is environmentally different from other moister parts of the island.

The fourth geographical zone is the narrow coastal plain around the perimeter of Puerto Rico, which includes beautiful sunny beaches, bioluminescent bays, and cities that help make Puerto Rico a popular tourist destination. There are 45 nonnavigable rivers in total in Puerto Rico which flow into the coastal plain, the longest being Río Grande de Loíza. Puerto Rico has no natural lakes and 12 artificial reservoirs. Common environmental concerns include population growth, urbanization, deforestation, water pollution, and soil erosion.

Puerto Rico's diverse economy is almost equally divided in terms of gross domestic product (GDP) by manufacturing, especially chemical and pharmaceutical production, and service industries, including tourism. Agriculture contributes 2 percent of the nation's GDP, and tourism 6 percent. The island's primary natural resources are clay, limestone, salt, sand, gravel, stone, copper, nickel, and petroleum.

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## Puncak Jaya

PUNCAK JAYA, THE highest peak of the Sudirman Range of Papua, is also the highest mountain between the ANDES and the HIMALAYAS, rising to 16,503 ft (5030 m) on the tropical island of New Guinea. It was first named Mount Carstenz after the Dutch navigator Jan Carstenz, who first sighted the peak from the coast in 1623. When the Dutch handed western New Guinea to INDONESIA in 1960, the peak was renamed Puncak Jaya, or "Victory Peak." Although Puncak Jaya is located close to the equator, it is high and wet enough to support some small glaciers within approximately 2.8 square mi (7.2 square km) of snow-covered area, stretching from about 1,000 ft (305 m) below the peak. At this height, daytime temperatures vary from 75 to 45 degrees F (7 to 24 degrees C), with frequent rainfall in the afternoons and evenings accompanied by strong winds. The peak was first climbed in 1962 by the renowned Austrian mountaineer, Heinrich Harrer, who lived for a year among the local Dani tribesmen. Since the early 1960s, these tribesmen, who traditionally adorn penis guards (*koteka*), have continued to become a popular subject for photojournalism.

The area is surrounded by unexplored rainforests which makes travel difficult, while it provides effective hideouts for a rebel group called Organisasi Papua Merdeka (OPM), or the Papua Liberation Organization, which is waging a guerrilla campaign for inde-



pendence from Indonesia. OPM's struggle can be traced to the New York agreement signed in August 1962 by representatives of the NETHERLANDS, Indonesia, the United Nations, and Papua. Another agreement signed in Rome, Italy, in May 1963 provided that West Papua would gain independence after 25 years of administrative guidance from Indonesia. While the failure of Indonesia to abide by the terms of the agreements was viewed as imperialistic, Papuan resentment is aggravated by the mining concession given to a U.S. corporation, which operates a large copper mine 18 mi (30 km) to the south of Puncak Jaya. The operation is alleged to have caused serious environmental pollution problems at the expense of the local inhabitants.

Visitors who choose to explore Puncak Jaya can begin their trek uphill from the last airstrip at Illaga village, proceeding on a tough trail for about six days through a cloud-misty rainforest, hilly terrain, muddy trails, and highland swamp and crossing streams with rain showers typically pouring four to seven hours a day. The return journey takes four days before the visitor boards a charter plane that flies directly to Jayapura, the provincial capital of Papua. As one of the "seven summits" of the world, Puncak Jaya attracts intrepid Westerners every year. The unique culture of the isolated hill tribes of central New Guinea is an added attraction to any visit to the area.

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## Pyrenees

THE PYRENEES MOUNTAINS form the natural border between FRANCE and SPAIN, and have been a more effective barrier between the two nations than other ranges of similar height because of their characteristic ruggedness and lack of usable passes. Even more so than the ALPS, the Pyrenees were impassable to travelers for many centuries. Today, however, they are among the most attractive mountaineering and rock

climbing locales in Europe. The chain is made up of two parallel ranges that run for roughly 266 mi (430 km) from the MEDITERRANEAN SEA west to the Bay of Biscay. The chain continues as the Cantabrian Mountains across northern Spain.

The mountains can be divided into three sections—west, central, and east—with the loftiest peaks concentrated in the central section. In total, there are more than 50 peaks over 10,000 ft (3,000 m). The crest of the ridge forms the border between France and Spain, with a few exceptions, such as the Val d'Aran, which is north of the range but within the borders of Spain. The tiny nation of ANDORRA is also sandwiched between France and Spain, at the site of one of the few historic passes across the mountains, reputedly the site of Charlemagne's crossing on one of his crusades against the Saracens in the 8th century. Another Pyrenean site associated with Charlemagne is the gap at Roncevalles (or Roncevaux), the setting of one of the most famous *chansons de geste*, the Song of Roland, where the Franks' most noble knight, Roland, lost his life in valiant defense of Charlemagne's army in 778. Today, a monastic hospice still aids travelers across the pass, the best in the western Pyrenees, located northeast of Pamplona, Spain; the hospice has been a key stopping point in the pilgrimage route to Santiago de Compostela since the 12th century.

The Pyrenees (Pyrénées in French, Pirineos in Spanish, Pirineus in Catalan) are older than the Alps, but are made of much harder material—mostly granite, some overlain with limestone—which has been resistant to erosion. The mountains have therefore maintained their size and ruggedness across the millennia. A lack of sizeable glaciers and relative dryness has also kept these mountains from appearing too worn. There is more rain in the west than the east, because of the prevailing winds off of the ATLANTIC OCEAN. As a result, the western part of the range is more lush than the east, with its Mediterranean climate.

The Pyrenees are characterized by a lack of any significant lakes and few large rivers. Rainwater flows down the mountains in swift torrents, called "gaves," which frequently tumble great depths over another feature typical to the region, high semicircular rock cliffs at the upper ends of stream valleys, known as cirques. The Gave de Pau contains both the highest waterfall in the range 1,525 ft (462 m) and the most famous cirque formation, the Gavarnie. The Pyrenees are also characterized by numerous caves and underground rivers. Water from the mountains drains south into the Ebro and the Mediterranean and north into either the

Mediterranean via the Aude, the Têt, and the Tech or the Atlantic Ocean via the tributaries of the Adour and the Garonne. The watershed between these northern streams is the small spur of mountains, the Corbières, which also form a sort of climatic barrier between the Atlantic and Mediterranean zones.

The north and south sides of the Pyrenees also differ in their structure. The French side tends to be steeper, with a more united front and broad faces of limestone or granite. The Spanish side is more gradual, includes some minor side ranges, and is also noticeably hotter and drier. The highest peak in the range, Pico d'Aneto at 11,168 ft (3,404 m), lies entirely within Spain. It is the center of the Maladetta Massif, close to the second highest peak, Pico de Posets (11,073 ft or 3,375 m), a few miles to the east.

The third-highest peak, Monte Perdido (or Mont Perdut in Catalan; 11,007 ft or 3,355 m), is considered by many to be the most beautiful in the range, towering over the picturesque valley of the Ordesa, which today forms a Spanish national park. Pic Long (10,472 ft or 3,192 m) is the highest mountain entirely in France and was famously first climbed in 1846 by the Duke of Nemours, son of King Louis-Philippe. Also in France is the Pic du Midi d'Ossau (9,465 ft or 2,885 m), which is an isolated pyramid with two summits and dramatic rock walls, considered to be one of the finest climbing spots in Europe, with more ascent routes than any other peak.

The Pyrenees are not rich in natural resources. There are some iron mines in the Ariège region of France, and some coal and lignite beds on both sides. More significant however, are the hot and mineral springs that are found throughout the range. Bagnières de Luchon and Eaux-Chaudes are both famous sulphurous hot springs. Another attraction to the Pyrenees are the religious shrines, most notably Lourdes. The mountains' flora and fauna are somewhat unique because of their relative geographical isolation. Among the range's unique species are the ibex and water-mole, blind cave insects, and several varieties of mountain rhododendron.

There are few large settlements anywhere in the Pyrenees, with the exceptions of the eastern and western extremities of the range, where the formations are low enough to allow railroads and highways and the development of larger cities, such as Perpignan in France, and San Sebastián in Spain, a major center of Basque culture.

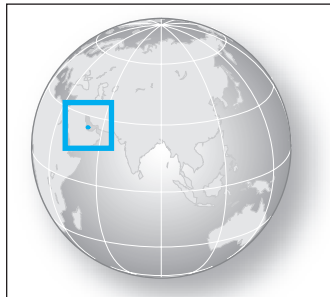
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## Qatar

**Map Page** 1122 **Area** 4,415 square mi (11,437 square km) **Population** 817,052 **Capital** Doha **Highest Point** Qurayn Abu al Bawl 338 ft (103 m) **Lowest Point** 0 m **GDP per capita** \$20,300 **Primary Natural Resources** petroleum, natural gas, fish.



QATAR IS LOCATED in the MIDDLE EAST; it is a peninsula projecting into the PERSIAN GULF and bordered in the south by SAUDI ARABIA. Qatar has been inhabited for millennia but never stood out as a commercial or cultural center in ancient times. The peninsula shared the barren dry nature of the great Arabian deserts to the south and drew the nomads of the interior and the coastal settlers of the Persian Gulf. The Qatar coast held oyster banks that provided the classic gulf item of trade, pearls. This was to be Qatar's main source of wealth for centuries and led to the growth of Doha (Arabic for "port") as the main settlement on the peninsula

Qatar enters historical record in the early 19th century when the Al Khalifa (ruling family of BAHRAIN) domination was challenged by the tribal leaders on the

peninsula. Britain was controlling the Persian Gulf at this time as a means of protecting its commercial interests in the INDIAN OCEAN. Attack of the Al Khalifa on Doha and the Qatari counterattack brought the British into the fray which was settled by treaty in 1868. This marked the first time Qatar was widely recognized as separate from Bahrain and the Al Khalifa family. The Al Thani family emerged as the ruling group in Qatar and learned to play the British and the encroaching Ottoman Turks off of one another.

In 1916, the Al Thani Sheikh signed a treaty with the British similar to those entered into by other Persian Gulf emirates and became a British protectorate. A 1934 treaty granted more extensive British protection and opened the way for exploration and exploitation of Qatar's petroleum potential. Across the Persian Gulf, World War II created a hiatus on oil development. In 1949 the beginning flow of oil wealth marked a turning point for Qatar. Slowly, development spread, often impeded by the age-old problems of strife within the Al Thani family and among the leading tribal groups of Qatar.

As Britain prepared to withdraw their protection from the Gulf states in a general reduction of military commitments east of Suez, Qatar considered joining into a coalition of emirate states. When their old nemesis Bahrain and the Al Kalifa family chose independence, so too did Qatar on September 3, 1971. Qatar

participated in the liberation of Kuwait and was supportive of the United Nations sanctions against Iraq in the 1990s. The current (2005) emir deposed his father in 1995 and rapidly increased the pace of national development, as well as opened Qatar to the buildup of U.S. military forces.

The economy centers upon the petroleum sector where oil reserves have diminished. However, Qatar has the third-largest proven natural gas reserves in the world and is rapidly developing and improving extraction and exporting capabilities. Qatar is seeking to replace expatriate workers with nationals by an aggressive program of education and training. Most Qatari, including the ruling family are followers of the Sunni branch of ISLAM. Islam is the official religion of the state and the people continue to be traditional in dress and custom.

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## Quaternary geography

THE QUATERNARY PERIOD is the time in which people became fully human and the dominant animal species on earth. The Quaternary is Earth's most recent geological period and includes the Pleistocene and Holocene epochs. (Eras, periods, and epochs comprise the geological calendar. An era is the longest unit of geologic time. Traditionally, geologists identify periods as beginning and ending with the appearance or extinction of certain life forms. Geologists divide the periods into epochs.) The Pleistocene epoch began about 1.8 to 2.6 million years ago (mya) and ended about 10,000 years ago. (There has been a long debate over when the Quaternary period began. On faunal grounds, it started about 1.8 mya. On climatic grounds, it started 2.58 mya with a rapid build-up of ice in the Northern Hemisphere.)

The epoch was subject to broad swings in temperature, swings that gave rise to growth and decay of glaciers. During the epoch, humans were hunters and

gathers. They spread out and established tentative footholds in far corners of Earth. The booming migrations were due to growth in human intelligence, which led to a multiplicity of advances in technical skills, especially in usage of fire, language, cooperative hunting methods, and the making of weapons for hunting. The Holocene epoch began only 10,000 years ago and continues today. It is an interglacial period, a time in which glaciers have largely disappeared. Holocene geography is most notable for the domestication of plants and animals by humans. Agriculture led to a dramatic rise and spread in human populations, tool making, food production, and human influence on the environment.

Quaternary geography is the study of the changing relationships between people and the environment during the Quaternary period. Geographers and other scientists—particularly anthropologists—use evidence from fossils, sediments, ice cores, tree rings, peat bogs, weather records, vegetation, and artifact dating to reconstruct changes in relations between humans and the land during the Quaternary. Quaternary geography has taken two tracks.

Research on the Pleistocene focuses on impacts of climate change on the environment and on early human evolution and migrations. Holocene research focuses on the rapid rise of humans as superior agents of environmental change. The following is a summary of changing human-land relationships during the Quaternary period.

### PLEISTOCENE ENVIRONMENT

Temperatures of the Pleistocene fluctuated between greenhouse and icehouse conditions. Swings in temperature varied in magnitude, but in total, there were more than 20 glacial advances (glaciations) separated by intervening periods of warming. Nearly all the glacial ice was in the form of enormous continental ice sheets. Ice sheets spread out over CANADA, GREENLAND, Scandinavia, and eastern SIBERIA in the Northern Hemisphere and ANTARCTICA in the Southern Hemisphere. During the last Pleistocene advance, ice sheets were up to 2.5 mi (4 km) thick. During times when the glaciers were at their maximum size, roughly 5.5 percent of the world's water was in the form of ice (the corresponding value today is 1.7 percent).

When global temperatures plunged to icehouse conditions, the ice sheets grew at the expense of oceans, causing sea levels to fall by up to 500 ft (150 m). During such glacial advances, shallow areas between continents and adjoining islands became land bridges. These land connections allowed animals and



human ancestors to migrate great distances from their areas of origin.

Pre-Pleistocene geography is notable for its legacy of early hominids (human-like apes). Hominids were the first upright-walking animals. They originated on the edges of forests in a volcanic region of East Africa about 4.0 mya. Pollen records in the region suggest that pre-Pleistocene glaciations created cycles of cooling and drying in Africa. Anthropologists believe that climate change, in turn, caused forest habitat to break up into grassland and forced biological advances in our early ancestors, including bipedal walking, which freed up the hands for complex tasks, such as gathering and carrying seeds and fruits and making and using tools. Although anthropologists are still seeking more fossil links, they have accumulated enough artifacts and other evidence to demonstrate an evolutionary line from the hominid *Australopithecus africanus* to us. The lineage includes two intermediary hominids—*Homo habilis* followed by *Homo erectus*—before *Homo sapiens*, or true humans, appeared.

The earliest evidence of *Homo habilis* comes from East Africa and dates to between 2.4 and 2.0 mya. This hominid was the first toolmaker, although the tools were primitive stone scrapers. No evidence suggests that *Homo habilis* migrated out of Africa. By mid-Pleistocene, about 1.0 mya, *Homo erectus* had replaced *Homo habilis*. The use of fire (probably from volcanic origins) enabled this human ancestor to spread out of Africa and into latitudes that are more northerly. *Homo erectus* also migrated east, across Asia as far as Java.

*Homo erectus* evolved into *Homo sapiens*, but the timing of the latter's appearance is still being debated. The earliest unquestioned evidence of human remains stems from Africa and Europe, where skulls and crude stone tools date to 0.5 mya. Around this time, the population of *Homo sapiens* may have included Neanderthals, but anthropologists sometimes classify them as a separate species (*Homo neanderthalensis*).

Skeletal, artistic, tool, and tool-making evidence proves that the Cro-Magnons of Europe were the first fully modern humans. The Cro-Magnon population grew and spread out rapidly from Europe beginning about 50,000 years ago. The earliest undisputed proof that humans reached far-flung New Guinea and AUSTRALIA dates to about 30,000 years ago. The least contested evidence indicates that humans reached South America, the farthest destination from Africa by land, roughly 11,000 years ago. Genetic and linguistics studies suggest that, as early migrations took place, geo-

graphical isolation gave rise to racial and language groupings.

### MAMMALIAN EXTINCTIONS

A glut of large mammals became extinct as the Pleistocene epoch ended. Their disappearance may be the first serious human impact on the environment. The list of mammals lost includes nearly 60 species, among them were mammoths and mastodons (larger than modern elephants), horses the size of Clydesdales, camels, giant ground sloths, saber-toothed tigers, and beavers as large as modern bears. Before their disappearance, humans fell prey to some of these mammals. There is no clear explanation for these particular mammalian extinctions, but many scientists argue that was due to a convergence of climatic change and improvements in human weaponry for hunting purposes.

Evidence for human weaponry causing the extinctions is clearest in America. The cold of the glacial maximum was so harsh for some warm-blooded mammals that they had to concentrate in whatever warm habitats remained. Simultaneously, humans began making Clovis points for spears. (The points are so named because archaeologists discovered the points first near Clovis, New Mexico.) Assiduously fashioned from stone, this double-edged point—when lashed skillfully to a throwing spear—gave humans the advantage they needed to kill dangerous prey at a safe distance. Many archaeological sites in America have yielded evidence of massive overkills by spear-wielding Clovis hunters, but there is some evidence in America and elsewhere to suggest that climate change may have been the main cause of such extinctions. There is an ongoing debate as to the ultimate cause of mass extinctions in the late Pleistocene—overkill or climate change.

The great northern ice sheets were virtually gone by the beginning of the Holocene (10,000 years ago), only a withering GREENLAND ice sheet remains today. (The only other existing ice sheets cover Antarctica in the Southern Hemisphere.) In response to interglacial warming, mixed woodland replaced barren tundra over large areas of Europe and North America and global sea levels rose significantly. Moreover, a combination of climatic and vegetation changes affected stream activity, weathering rates, and soil formation. The same warming extended the geographical range of large grazing mammals, edible plants, seeds, and fruits. The geographical extension of animals and plants aided the spread of humans living in sedentary farming communities.

The adoption of agriculture by people took place first in the FERTILE CRESCENT about 11,000 years ago. Today, tributaries of the Tigris and Euphrates rivers in borderlands separating IRAQ, TURKEY, and IRAN drain this lush arc of foothills and valleys. Main diffusions of food production were from the Fertile Crescent region to Europe, EGYPT, ETHIOPIA, Central Asia, and the Indus Valley. Later independent discoveries and diffusions of agriculture took place from the SAHEL and West Africa to East and southern Africa; from CHINA to tropical Southeast Asia, the PHILIPPINES, INDONESIA, KOREA, and JAPAN; and from Mesoamerica to North America.

These dispersals forever changed the face of Earth by bringing new plant and animal species to new areas. Moreover, in the process, agriculturalists cleared vast areas of natural vegetation to make way for the new crops and livestock. Agriculture made possible the feeding of much larger human populations in many regions. It also opened the way for complex societies in which individuals could specialize in activities other than food production.

Specialization led to the INDUSTRIAL REVOLUTION of the 18th century. Industrialization resulted in an explosion in human population. The present list of environmental problems brought about by industry and population growth is daunting: disappearing forests, plant and animal extinctions, soil degradation, overgrazing, acid rain, water and air pollution, and ozone depletion. Moreover, a large body of scientific evidence suggests that burning fossil fuels and forests has led to excess accumulations of carbon dioxide and other greenhouse gases. The excess gases, in turn, are raising global air temperatures, causing remaining glaciers to melt, sea levels to rise, and ecosystems to change.

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## rainforests

THE WORLD'S RAINFORESTS are often considered the world's "hot spots" since they are often found in tropical climates and they are home to the majority of the world's species. As of 2000, studies and surveillance indicated that rainforests may have from one-half to two-thirds of the world's species, despite only covering 5–7 percent of the world's surface. Biodiversity is just one of the many advantages that rainforests provide for the planet and that make it worthwhile to protect them. Other contributions from rainforests include carbon sequestration, controlling global warming, preventing soil erosion, minimizing carbon emissions through the photosynthetic process, and preventing DESERTIFICATION. Despite these positive aspects of rainforests, they continue to be threatened by market forces, increased demand for agriculture and a lack of a policy framework in most of the developing countries in which these rainforests are found.

Within the tropics, where the temperature lingers at 70 degrees F (20 degrees C) and higher, a rainforest is a common BIOME to encounter. Tropical zones occur primarily within the equatorial zone, 10 degrees within the equator both north and south. The largest areas of tropical rainforest are in the Amazon Basin of South America and in western Africa and INDONESIA. There are many other smaller areas where rainforests abound throughout Central America and parts of the Pacific. With annual rainfall of over 79 in (200 cm), rainforests are rich with flora and fauna. There may be a dry season that lasts for a month or two, but this is substantially milder than the winter and summer contrast experienced in the temperate zones. Seasonal variation in the rainforests is very slight.

The soils found in rainforests are typically old, of decomposed organic matter, and not very fertile to support an abundance of agriculture. Because of the heavy rainfall, leaching of all soluble constituents of the original rock layer occurs, leaving behind a latosol, or a red or yellow soil composed mainly of aluminum and iron oxide. Rainforest soils are not rich in nutrients; the nutrition of the rainforest is lost when logging occurs, since the trees are the main source of nutrients for the ECOSYSTEM.

The components of a rainforest are numerous and diverse. The upper layer or "story" consists of trees 147 to 180 ft (45 to 55 m) tall with round or umbrella-shaped crowns, and they are referred to as "emergents." These trees do not necessarily form the canopy characteristic of rainforests; they are tall and small in

diameter. The second layer of trees is about 98 to 131 ft (30 to 40 m) tall. The third layer of vegetation rises about 33 to 82 ft (10 to 25 m), and this story contains most of the flowering and fruit produce of plants. The shrub story, or the “understory,” includes dwarf palms, bananalike leaves, and two flora especially characteristic of rainforests: lianas, or vines rooted in soil that climb to the canopy; and epiphytes, plants that grow on other plants.

### COLDER RAINFORESTS

Despite the vast majority of the world’s rainforests being tropical and found in the world’s warmer regions, not all are located in the warm belt of the globe. The world’s oldest forest spans along the western coast of North America, from the panhandle of ALASKA to northern CALIFORNIA. Canopy heights of 197 to 230 ft (60 to 70 m) are usual here, and in the coastal California redwoods, the canopy top regularly reaches 328 ft (100 m). The record height for a redwood is about 367 ft (112 m), the same height as a 28-floor building.

The Tongass Forest, located on the panhandle of Alaska as part of this Pacific Northwest spread, is part of the last remaining temperate rainforest in the world. Tongass covers more than 600 mi (965 km) and is home to the largest collection of bald eagles and grizzly bears.

The other, the Russian Taiga, located in the western region of RUSSIA, covers more than 2 million miles and could cover the whole of the continental UNITED STATES. Temperate forests are often called evergreen forests and are often considered ancient because of their ancient tree populations. They typically consist of coniferous trees and/or evergreen broadleaf trees. Other typical members include Douglas firs, western hemlocks, and western cedar trees. These temperate forests are unrecognized gems in the Northern Hemisphere that may actually host more species than their tropical counterparts because they possess the oldest and tallest trees in the world, and maintain more plant matter as well. The temperate forests are from where hundreds of substances have been extracted for pharmaceutical use, including the famous taxol, a drug used as an anticancer substance.

Tropical or temperate, rainforests are the sources of all kinds of environmental services and commercial commodities to which we are acquainted through the force of our global economy today. Some of the foods that were originally from rainforests around the world include cashew nuts, Brazil nuts, macadamia nuts, bananas, plantains, pineapples, cucumbers, cocoa (choco-

late), coffee, tea, avocados, papayas, guavas, mangoes, cassava (a starchy root), tapioca, yams, sweet potatoes, okra, cinnamon, vanilla, nutmeg, mace, ginger, cayenne pepper, cloves, oranges, grapefruit, lemons, limes, passion fruit, peanuts, rice, sugarcane, and coconuts (mostly from coastal areas).

In addition to environmental services and commodities, the world’s rainforests are also home to thousands of the world’s indigenous peoples. Many of these groups, like the Yanomamo tribe of the Amazon rainforests of BRAZIL and southern VENEZUELA, have lived in scattered villages in the rainforests for hundreds or thousands of years. These tribes get their food, clothing, and housing mainly from materials they obtain in the forests. Indigenous peoples are mostly hunter-gatherers; they get their food by hunting for meat, fishing for fish, and gathering edible plants like starchy roots and fruit. Many also have small gardens in cleared areas of the forest. Since the soil in the rainforest is rather poor and infertile, the garden areas must be moved after just a few years, and another part of the forest is cleared.

### THREATS

The world’s rainforests and their peoples are being threatened by various forces and global needs. Most indigenous populations are declining from diseases like smallpox and measles, which were inadvertently introduced by Europeans, and governmental land seizure, which has monopolized the rainforests, their homes, in ways that are incomprehensible to their ways of life. Depletion is on the rise in southern Asia, INDONESIA, the PHILIPPINES, Central America, and Brazil. Destruction is somewhat slower in other areas including GUYANA, SURINAME, FRENCH GUYANA, the western part of the Brazilian Amazon, and in Africa’s Congo Basin Forest.

Illegal logging occurs virtually everywhere, as certain woods, like mahogany, become more scarce. Attempts to slow its extinction are poorly regulated. Precious woods that are supposedly under the protection of a government are by and large unmonitored since it takes resources and transparency to adequately lead a monitoring process and enforce legislation. Many developing countries in which the rainforests are situated simply do not have the funding to maintain proper monitoring of parks and lands classified as reserved. As illegal logging has skyrocketed in the Central and South America, where forests like the Brazilian Amazon, CHILE’s Patagonia, and even forests that have officially been labeled as national parks lie in harm’s

way as the global demand for rare, tropical woods increases.

Rainforests are also the target of another global market force: agricultural expansion. In the 1990s, demand for beef in the United States, Europe and Latin America greatly increased as fast-food restaurants proliferated all over the world. The multiplication of fast-food restaurant road signs literally spelled out the imminent global change in rising demand of beef. And as demand for beef rises, so does demand for space where cattle can graze. Unfortunately, even though rainforests do not maintain the most fertile of soils and are not equipped to nurture agriculture, cattle grazing is even harder on the land because of the water requirements, the use of monocultural grasses for feed, and lack of enrichment of the soil.

Agriculture of crops has evolved and been revolutionized with the proliferation of genetically modified organisms (GMO) and has moved offshore to developing countries as developed countries diminish their agricultural sectors. Soy, a very lucrative crop, has been increasingly farmed and harvested in Brazil, leading to rapid deforestation that occurs at an exponential rate since the crop requires unharvested soil every few years. Moreover, while soy is lucrative as an export for the Brazilian economy, less than 20 percent of the Amazonian soil is suitable for growing it. The problem lies in the global market demand for soy and other crops like it, which may satisfy a consumer demand but impairs a developing country's economy as well as its natural resources. The solution to sustainable harvesting of the resources of rainforests is to enable the domestic economy that usually depends on its natural resources—often to the extent of endangering species, rapid deforestation, and extensive environmental threat—to profit from conservation. This may occur through developing sustainable tourism.

Other reasons why rainforests are being threatened and deforestation is escalating to about a loss of 40 million acres (16 million hectares) a year, the size of the state of WASHINGTON, is due to the needs of the THIRD WORLD poor. When a country suffers from poverty, environmental degradation does not become a priority, and so unsustainable agricultural practices are extremely common in the parts of the world where the world's rainforests are often located. Deforestation also creates a new problem of refugees. Thousands of indigenous tribes that have historically lived in the rainforests of the world have been literally run out by deforestation and the expansion of agriculture. Despite the morose picture of the loss of rainforest around the

world, the global economy has become porous enough to distinguish a new market for what are called "environmental services," such as carbon sequestration and preservation of biodiversity. A carbon sequestration program would assign a dollar value to a hectare of forest, essentially assigning a dollar value to the amount of carbon being sequestered in that hectare, and therefore making a hectare of forest more valuable than a hectare of pasture land. The key element in the success of this kind of program is the participation of governments. Because these kinds of relationships usually occur between developed and developing nations, it is imperative that the developing countries play a greater role in negotiations and have the resources to monitor rainforests to ensure their maintenance.

### REASONS FOR HOPE

There are also reasons for hope because of the public awareness made possible by civil society organizations advocating on behalf of the rainforests and their indigenous communities. In addition, several intergovernmental institutions, such as the European Forest Institute, represent emerging economies and developed countries working jointly to preserve forests that share political boundaries and that provide a variety of services for their citizens. Other institutions serving the same purpose include the World Commission on Forests and Sustainable Development, a massive joint government effort to create awareness of the services provided by rainforests that the world's population cannot survive without and to formulate sound policy practices that address poverty and trade so that deforestation can be slowed to a sustainable rate.

The ways of business and corporate responsibility are also changing, as are the patterns of consumer behavior as consumers become better informed about the status of the world's rainforests and what remains of them. Companies like Home Depot have been forced to stop selling old growth wood products because their customers do not want to buy products from endangered forests.

Scientists are increasingly vocal about the need to protect what remains, politicians are careful not to be branded as antienvironmental, and every year, many countries add new protected areas. Such public actions and efforts have been evident in the last 20 years. Today's social trends present positive forecasts for protecting the planet's remaining old-growth forests. However, it remains to be seen whether society will change quickly enough to stop logging companies and others who have a head start in destroying rainforests.



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## Red Sea

THE RED SEA CONNECTS the MEDITERRANEAN SEA to the INDIAN OCEAN via the Suez Canal. It lies in the Great Rift Valley between Africa and the Arabian Peninsula. EGYPT, SUDAN, ERITREA, and DJIBOUTI border it to the west, while ISRAEL is to the north and JORDAN, YEMEN, and SAUDI ARABIA are to the east. Scientists believe it was formed 20 million years ago when the Earth's crust weakened and was torn apart, creating a jagged rift across Africa. Volcanoes erupted on either side, creating volcanic mountains. Water filled this part of the fault, creating the Red Sea. The sea is still widening by about .5 in (12.7 cm) each year.

The sea has an area of about 170,000 square mi (440,300 square km). The long, narrow body of water is 1,240 mi (2,000 km) long and measures 185 mi (300 km) at its widest point. The Red Sea is a very deep sea, reaching depths of almost 9,840 ft (3,000 m) in the center.

The Red Sea is saltier than any ocean. This is partly due to a high rate of evaporation because of the heat and partly due to low annual rainfall. The water is composed of 3.9 to 4.1 percent salt. At its northern edge, the Red Sea splits into two gulfs: the GULF OF AQABA to the west and the Gulf of Suez to the east, flanking the Sinai Peninsula.

The area has historically served as a departure point for pilgrims traveling to Mecca. Its strategic location made the Red Sea an important trade route in ancient times. During the time of the Roman Empire, trade in spices and other exotic goods flourished between Egypt and INDIA. Other goods included cloth, aromatic woods, incense, coffee, and tea. There was often conflict in the area, as different groups wanted to control the lucrative trade route. The Red Sea's impor-

tance declined when an all-water route around Africa to Europe was discovered in 1498.

The Red Sea rose to importance again when the Suez Canal opened in 1869. It provided a more direct connection between Europe and East Asia and AUSTRALIA. The canal was closed for several years after the Arab-Israeli War in 1967. It was reopened and enlarged in 1975 and traffic again increased.

Important ports include Jedda, Mukalla, and Suez. Jedda, located in Saudi Arabia, is just 31 mi (50 km) from Mecca and serves as the main port for pilgrims coming by air or by sea. It's also a commercial center and a center for importing livestock. Jedda has iron and steel plants and oil refineries as well. Mukalla, in Yemen, is located on the Gulf of Aden. It's the area's most important port, but monsoons make it impossible to use between June and September. Mukalla's economy is based on the fishing industry, but boatbuilding is also important. Suez lies at the southern entrance to the canal and has been a commercial port since the seventh century. It was devastated during the Arab-Israeli War, but has managed to recover. Industry includes petrochemical plants as well as cement and fertilizer plants. Fishing is also important to the economy.

The Red Sea area has a diversity of flora and fauna. Marine turtles, including green, loggerhead, leatherback, olive ridley, and hawksbill flourish there. A major bird migration route makes the Red Sea a favorite destination for bird-watchers. Here you might see a pink-backed pelican, a brown booby, a white-eyed gull, or a white-cheeked tern.

The Red Sea has become a popular diving and snorkeling destination, because of the variety of marine life beneath the sea. Seventeen species of fish are endemic to the area, meaning they are not found anywhere else. Dugong, beaked whales, white-tip reef sharks, butterfly fish, giant clams, and several species of dolphins can be seen around the coral reefs.

A few of the sea creatures are dangerous to divers. Shark attacks in the Red Sea are rare, but other species pose a threat to swimmers. The main danger comes from animals with poisonous stings rather than those that bite. The stonefish and scorpionfish lie on the bottom of the sea, perfectly camouflaged. When stepped on or touched, they sting. Their poison causes swelling and unbearable shooting pains. People have died from the stings.

The Red Sea features prominently in the Bible in the book of Exodus. According to the Bible, Moses was leading thousands of formerly enslaved Jews out of Egypt. Pharaoh sent men in 600 chariots to stop

them When the Jews came to the Red Sea, they thought they would be recaptured, but Moses stretched out his hand over the sea and the Lord drove the waters back, making a path of dry land where the sea was divided. The Jews escaped across the dry path, but when the Egyptian chariots followed them, the wall of water engulfed them, drowning them all.

Scientists have advanced several theories explaining the parting of the sea. One says the coral reef beneath the sea used to be closer to the surface. It hypothesizes that if the wind blew all night, it could drive the water back for half an hour, creating a dry path for the Israelis to cross.

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## redistricting

THE PROCESS OF redistricting means dividing anew into districts or, in particular, to revise the legislative districts of a certain area, typically of a city or state. In the UNITED STATES, the process of redistricting is also referred to as "legislative reapportionment," which the U.S. Constitution requires so that Congressional representatives are elected according to population. The process of redistricting redraws the legislative district boundaries to reflect population changes and is usually undertaken every 10 years, when the results of the decennial census have been calculated. Redistricting reapportions the population of a state's Congressional, state representative, senatorial, and other legislative districts, ostensibly to ensure the existence of an appropriate number of districts of approximately equal inhabitants.

Although state legislatures are not required to abide by federal constitutional statutes, they are obligated to apportion according to population, geographic size, special interests, and territorial divisions like counties and towns. The legislature is responsible for appropriately redrawing district lines in order to conduct elections for representatives to Congress. Unfortunately, like-minded politicians often create districts that give disproportionate power to small, partisan, unrepresentative minority groups, who some-

times abuse their control. The process of corrupt redistricting is known as gerrymandering, a word whose source lies in the shape that tendentious redistricting often takes: that of a salamander, with extensions into population areas resembling on a map the legs and tail of a salamander.

Historically, some states legislatures avoided redistricting, despite population shifts, for almost 60 years. It was not until 1962 that the U.S. Supreme Court, in *Baker v. Carr*, ruled that a voter could challenge redistricting if it seemed to violate the equal protection clause of the Fourteenth Amendment to the Constitution. Within a year, lawsuits calling for redistricting had been filed in at least 34 states. In 1964, in *Reynolds v. Sims*, the Supreme Court determined that population, according to the one-person, one-vote rule, must be the foremost consideration in all redistricting plans for both upper and lower houses of state legislatures.

More recently, in TEXAS, redistricting caused considerable friction between Republicans—who controlled the redistricting process—and Democrats and minorities. In addition to carrying out the redistricting mandated after the 2000 census, Texas legislators, led by U.S. Congressional majority leader Tom Delay, decided to redistrict the state again in 2003, to create a more "Republican-friendly" Congressional map of the state. While many Democrats held that the new redistricting plan violated the Voting Rights Act, three federal judges upheld the process. Democrats said they intended to appeal the ruling to the U.S. Supreme Court.

In the new plan, the number of Republicans representing Texas in Congress increased. Republicans maintained that the new districts better reflect a growing trend of Republican voters, while Democrats hold that it is intended to weaken minority-voting strength in key districts. The Fort Worth district, for example, stretches from that city to the OKLAHOMA border to include a majority of wealthy white voters who counterbalance the population of African Americans in the inner city area, who traditionally held voting sway in the district. Republicans hoped the redistricting would increase their party's Congressional representation from western Texas and result in the election of a member of Congress who would support oil and gas rather than farming interests.

A similar situation obtained in Austin, in which the city was divided into three districts that extend far into distant, rural ranching areas. For example, the city's southern portion was gerrymandered into a district

that extended 300 miles south, to the Mexican border. While Republicans claim such new redistricting will better represent rural south Texans, Democrats object that the new districts will leave Austin—the capital and most liberal-minded city in Texas—without representation in Congress. As a result of the 2003 redistricting, Republicans said in 2004 that they hoped to win at least 22 of the 32 seats Texas holds in Congress, seats divided evenly between the two parties before the redistricting.

While the Texas case is only one example, it is clear that the redistricting process can be distorted to support a majority party's continued strength, or to deny Congressional representation to certain minorities. Originally thought by founding fathers, such as Thomas Jefferson, to be a process that would ensure continued fair representation and substantial turnover among members of the House of Representatives, the redistricting process has turned out to be the single most effective method for political parties, once in power, to solidify their control of the political process that will determine how a particular seat in Congress is filled. As a result, the House of Representatives has become the more stolid and unchanging house of Congress, where initial election can mean lifetime membership, ensured via the redistricting process.

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## region

THE NOTION OF REGIONS has been central to geographic thinking, first because of the importance of the observation and its corollary, and second because of the classification in classic geography emphasized by the empiricism and primacy of the field survey. The term *region* originates from Old French and stems from the Latin *regio*, meaning "direction and district," and from *regere*, meaning "to rule," or direct and thus

give the dimension of political space. Contemporary geography considers the region as a spatial entity of a middle size (between the local and the national level), which may be different from one country to another and one period to another. Regions can be a political entity used, for example, by the United Nations, which divides the world in a certain number of regions with variations in size. It is under this term that it is possible to designate a group of states, or a continental group such as the MIDDLE EAST or Southeast Asia, and also to refer to regional powers or regional conflicts. In addition, the term has changed from the traditional definition that includes a political or scale dimension to include urban, natural, desert, or jungle areas, among many others.

The concept of region has been at the core of the French school of geography. Paul Vidal de la Blache (1845–1918), a French geographer, was the first to formalize the concept of region. It was for him a natural area that is translated in the landscape as the result of an inter-relationship between the natural environment and human activities. In the UNITED STATES, in the beginning of the 20th century, the evolution of the concept of regions changed to be recognized and used in practice. The administration of President Woodrow Wilson (1856–1924) chose Isaiah Bowman, director of the American Geographical Society and region expert, as territorial adviser at the Versailles Peace Conference concluding World War I. Geographers in Europe were consulted for the internal political reorganization in several countries.

Traditional geography, that is to say, the descriptive taxonomy of regions, was criticized in the 1960s and led to new classification, such as the structural taxonomy making a differentiation between formal, functional, nodal, and equitable regions. The study of regions has been associated in geography with area-differentiation and chorology. The regions concerned here have distinguishable cores; however, the regional characteristics are losing their peculiarities with increasing distance from the core. David B. Grigg (1965) has examined the similarities between regionalization and classification and supported the regional taxonomy as the basis for formal region-building algorithms.

On the contrary, the functional regions are concerned with the human organization of space. They are defined as areas in which a higher degree of mutual socioeconomic interactions exist within them than with outside areas. This functional geography joins the space of regional science. The nodal region merged in the 1950s, when Derwent Whittlesey (1954) developed

the concept of cores and regional dominance in networks. Thus, the development of the different regions concepts from the 1950s has led to the importance of planning and the preparation and implementation of regional policy by practitioners and service providers.

In the 1980s, nonfunctionalist formulations emerged and were linked to the renewed interest of the regions in the area of regional geography. Torsten Hagerstrand developed in spatial analysis the concept of time-geography to show the importance of the temporal variable in the constitution of space at different scales in the regions. Continuing on the ideas, Nigel Thrift has conceived the region as a “meeting place of human agency and social structure.” He is also inspired by Antony Giddens’s work (1984) on structuring theory. Allan Pred (1984), besides his schematic model of the region as process, has opened an approach to the Marxist geography particularly regarding the division of labor, layers of investment and the uneven development all these concepts accentuating the social practices developed above.

It is interesting to note how the idea of regions can survive with the digital technology of information and communication and with the growing role of cities that offer opportunities for convenient meetings to the actors of the new economy in a global environment.

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## regionalism

REGIONALISM IS A COMPLEX and contested concept. As such, there is no straight or simple answer to

what regionalism is. One thing for sure is that regionalism is closely related to REGION. Since a region may connote geographical contiguity ranging from a small neighborhood to a few cities right up to several states and continents, regionalism thus can exist within a state, as parts of states, among states, and between groups of states. But contiguity is not the only variable in delineating regions, which means that regionalism may well occur irrespective of spatial boundaries. It is therefore safe to say that regionalism entails an intricate set of ideas, behaviors, and allegiance in the conscious minds of individuals as to how they perceive their region, hence giving it a distinct physical and cultural feature. The same group of people could be engaged in more than one form of regionalism as regions overlap and change over time. This happens because of the nature of regions as entities that are socially constructed but can also be predefined. Depending on the objective and purpose of the regionalism pursued, some forms would be more elaborated and focused compare to others.

Within a state, regionalism is both positively and negatively correlated with the idea of region. Pessimistically, regionalism can be one manifestation of ethnic nationalism. This could happen in countries where ethnic groups are identified via regions. These groups are normally the minorities and most often than not unfavorably treated or forgotten mainly because there is a lack of integration between the core and the periphery. The problem of assimilation and stark cultural differences are some factors that give rise to the pursuit of regionalist discourses to secure and preserve their beliefs and rights should they perceive the actions of the state as detrimental to their own. Those with higher aspirations and means may set political agendas for separatism and independence. Such activities no doubt challenge the legitimacy and authority of the state. States with many capabilities will try to suppress those aspirations through carrots and sticks, those with fewer capabilities might designate trouble areas as autonomous regions, and those that are incapable may see their territorial boundaries redrawn.

This mostly affects large states, young independent states, politically troubled states, and failed states. Some known examples with varying degrees of regionalism are the Chechens in RUSSIA, the Abkhazian and South Ossetian in GEORGIA, the Uyghurs and Tibetans in CHINA, and the Acehian and previous East Timorans in INDONESIA. While ethnicity plays a central role, other factors such as ideology can be a powerful tool for regionalism. Religion and communism, as separate ele-



ments or in combination with ethnicity like the predominantly ethnic-Chinese supported communist insurgency in Malaya, could push for the same kind of regionalism.

### POSITIVE SIDE

On the positive side, regionalism takes a different form. It may simply reflect the desire of communities that are interested in increasing the efficiencies of their respective towns, counties, or cities through better management and administration. This involves building coalitions that are tailored to specific projects such as land use, housing needs, environmental control, health care, job creation, bioterrorism, traffic improvement, poverty eradication, and others.

Many of these problems cannot be easily handled or solved within the existing political boundaries because of changes in demography and cross-border human activities. As they spill over and become regional issues, interconnectedness then requires local administrations to forge strategic alliances so as to effectively address those concerns. Such regionalism can lead to accountability and better cost utility by leveraging on the competitive advantages of those in alliance. States may also decide to merge towns or cities for similar effects.

The same dynamics could exist for regionalism that transcends parts of bordering states. Mostly centered on economic cooperation, three or more countries may choose to pursue regionalism by earmarking a regional space for development. Geographically adjacent areas are linked to form a distinct space in which differences in the factor endowments (land, labor, capital, etc.) and levels of development are exploited for the purpose of promoting external trade and direct investment. This imaginative space has been given various unofficial terms such as growth triangle, growth quadrangle, transnational economic zone, natural economic territory, circle of growth, extended metropolitan region, or, simply, growth area. Regionalism of this sort is attractive because participating countries are able to gain from the differences in comparative advantage which serve to complement rather than compete with one another. Economic complementarity is not the only motivating factor, as it can also include cooperation on natural resources, infrastructure development, and even tourism. Successful projects can be replicated elsewhere with different modalities of cooperation to meet the local needs and conditions of the region in focus.

Furthermore, a country can participate in several projects at the same time. Such undertakings have the

ability to prop up unproductive peripheries by overcoming rigid territorial barriers and utilizing shared experiences.

Some examples are the Indonesia-MALAYSIA-THAILAND growth triangle, the ZAMBIA-MALAWI-MOZAMBIQUE growth triangle, the Tumen River growth area, the Greater Mekong subregion, and the Gulf of Finland growth triangle.

On the other hand, cross-border regionalism could have a negative impact on states. Rather similar to regionalism within states, this may involve the manifestation of ethnic nationalism that goes beyond states' borders. One example is the Kurdish minority located in a region that spans across four countries, including parts of IRAQ, TURKEY, IRAN, and SYRIA. The Kurdish people, while lacking in political unity, have a strong belief and aspiration for independence, but infighting often results in their suppression and repression by the countries they reside in.

Between states, regionalism generally aims at finding regional solutions to regional problems through regional cooperation. A group of neighboring countries with common concerns may decide to gather and commit themselves to dialogue on certain areas of cooperation such as economy, finance, security, health, welfare, cultural, environmental, human rights, and crime. The amount and degree of cooperation varies depending on the problems faced. Security issues could cover terrorism, piracy, and nuclear weapons, while economic issues may focus on trade and investment, and environmental issues would concentrate on pollution, smog, and illegal logging.

### INTERDEPENDENCE AND GLOBALIZATION

All these issues cannot be tackled alone, as they are the manifestations of interdependence and globalization. This is where regionalism can be effectively employed to deal with the challenges of globalization. Regionalism allows smaller and weaker states to bind their strengths for better results. States may further decide to establish regional groupings or organizations to institutionalize their cause on matters of importance. Some of the typical regional arrangements are alliances, ententes, free trade areas, and custom unions.

The NORTH AMERICAN FREE TRADE AGREEMENT (NAFTA), for example, was established to enhance regional economic cooperation. So were the Economic Community of West African States and the Mercado Común del Sur. The Association of Southeast Asian Nations (ASEAN) was originally an organization concerned with security matters but has since moved to

focus on economic regionalism. Groupings with higher ambitions can take regionalism beyond simple cooperation toward integration, as the EUROPEAN UNION did. But regional integration may imply the pooling of sovereignty and interference in state affairs and so directly challenges the state system. Therefore, regionalism between states can have both positive and negative implications and can be seen in stages with political union as the ultimate goal.

The concept of regionalism can be broadened to include cooperation between groups of states. An established regional organization may want to expand its cooperation with countries or regions outside of its own. In East Asia, for example, the Asian financial crisis resulted in a closer relationship between the South-east Asian region and the Northeast Asian region. Economic and financial regionalism is being pursued under the framework of ASEAN Plus Three. Interregionalism such as the Asia-Europe Meeting, which links East Asia to Europe, is another case in point. What's more is the notion that regionalism as a social construction can occur out of shared common political, economic, or cultural objectives with no bearing to geographical proximity. The Group of Eight and the NORTH ATLANTIC TREATY ORGANIZATION (NATO) are two examples that bring to the table different sets of countries with different purposes but yet are free from any geographic outlay.

### REGIONALISM AND REGIONALIZATION

The concepts of regionalism and regionalization are most prevalent in the study of international relations and international political economy. More often than not, these two concepts are used interchangeably to mean the same thing. Differences, however, do exist between them. There are a few interpretations in distinguishing the two concepts.

Regionalism, as a general phenomenon, may refer to a formal project, policy, or scheme promoted by regional states. As a political project, it contains a certain set of ideas, norms, values, principles, and identity that is shared by the participating members. Hence, the characteristics of one regionalist project would obviously be different from another. The aim of such projects varies ranging from promoting a sense of regional awareness to forming supranational institutions.

The process needed to achieve the aim of the project is what can be termed as regionalization. It is an empirical process with an activist element that harmonizes states policies by changing heterogeneous factors defined as obstacles to closer cooperation toward in-

creased coherence and convergence within the given geographical area. Regionalization can also take a different meaning, one that is not tied to a regionalist project. Here, regionalization takes place as the result of spontaneous forces. It depicts a multidimensional and undirected natural process of social and economic interaction driven by the people as nonstate actors that could plausibly contribute to the growth of societal integration and transnational civil society within a regional space. Such vigor may instead give rise to regionalism with the emergence of regional groups and organizations.

Regionalism and regionalization anchored in the economic domain may have a slightly different interpretation. Regionalism can be understood as a political process whereby states cooperate and coordinate their economic policies across regions. One method pursued by states is to form regional trading arrangements. These arrangements furnish states with preferential access to members' markets. Free trade agreement, as it is often called, dates back to the early 1960s but has become an increasing trend in the post-Cold War period marked by a shift from the old protectionist regionalism to the open and flexible new regionalism. But there is still a constant debate as to whether regionalism through trade agreements complements or contradicts the world trading system. Regionalization, on the other hand, is understood as the concentration of regional economic activities and trade flows of market actors. This may involve transnational corporations, entrepreneurs, consumers, investors, and capitalists that have a regional interest.

All these suggest that not only are there differences but the relationship between regionalism and regionalization is progressive and robust. In short, regionalization can both precede and flow from regionalism. One interesting example is the East Asian region, where decades of economic regionalization with the absence of regionalism created an intricate web of interdependence and then saw a postcrisis emergence of regionalism geared toward facilitating further regionalization.

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## religion

RELIGION CAN BE DEFINED as a unified set of beliefs, values, and practices of an individual or a group of people that is based on the teachings of a spiritual leader. It includes codes of behavior, faith in and devotion toward a supernatural power or powers, and a framework for understanding the universe. Religion is an important component of many individuals' lives and identities, and it is deeply embedded into most if not all societies. From a geographer's standpoint, however, religion is meaningful for the following reasons: It has a varying presence in every inhabited locale on Earth; religion displays clear geographical patterns; many of the characteristics of religions and their development and their impact are rooted in geographic factors; in order to better understand a place, we must consider its religious character; religion is one of the most or the most important components of cultural groups; and religious issues are often the root cause of many geopolitical problems.

The geography of religion examines the way in which religion is expressed on the Earth and its social, cultural, and environmental impacts. More specifically, it looks at, maps out, interprets, compares, and analyzes various religions' origins, diffusion, subsequent distributions and effects, and the religious landscapes they create. The geography of religion additionally investigates how religion impacts lifestyles, commerce, demography, gender issues, political geography, the environment, and other components of society and culture. With the growing issues of militant ISLAM, religious fundamentalism, and cultural politics, there is an increasing awareness of the field.

Geographers primarily categorize religion into two types: universal and ethnic. Universal or proselytic reli-

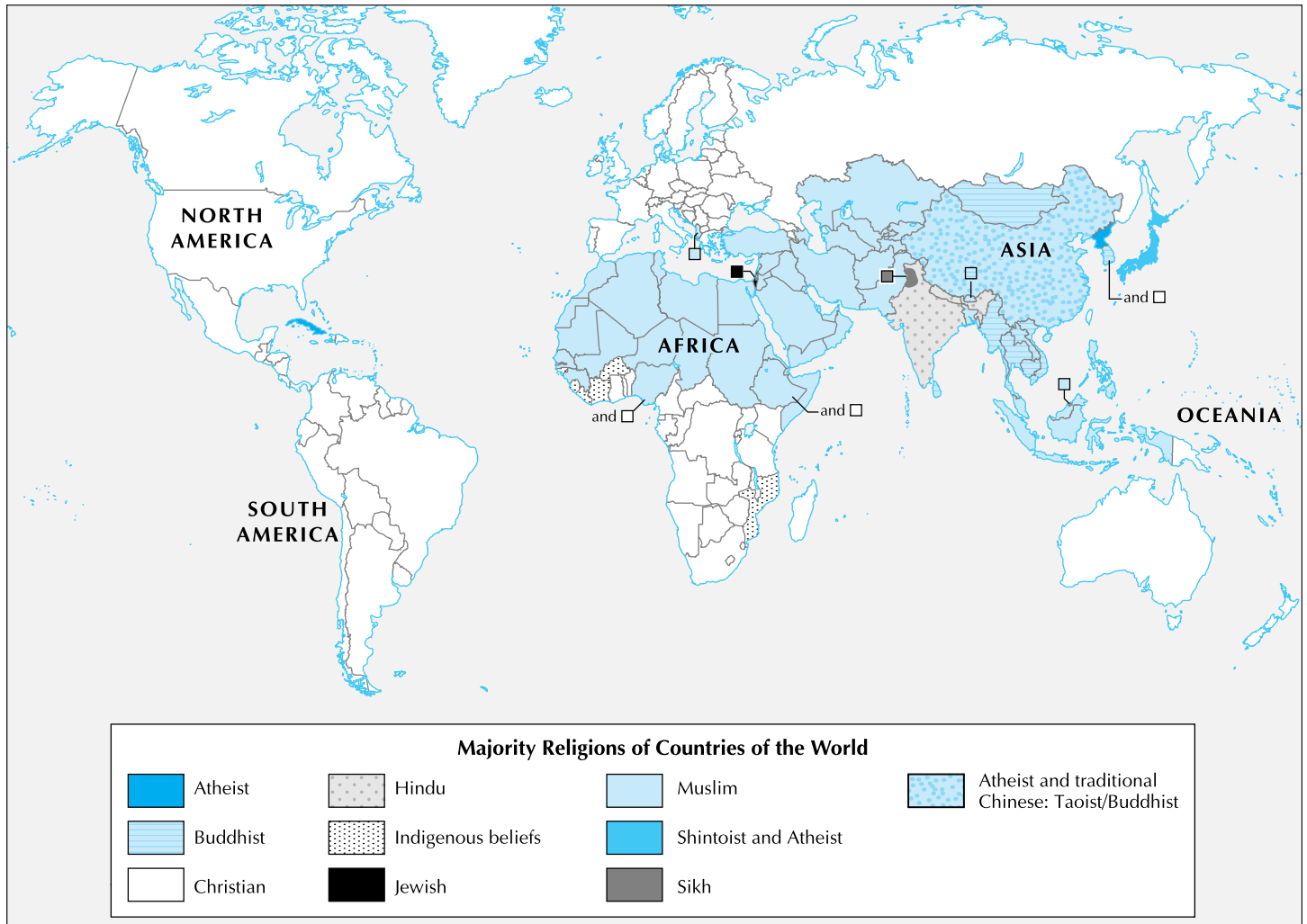
gions actively solicit new converts and have widely and quickly diffused across the globe. Christianity, Islam, and some forms of Buddhism fall into this category. Ethnic religions, on the other hand, are associated with a particular ethnic group and customarily do not proselytize. They often dominate a certain cultural group, are usually confined to a particular country, and spread spatially at a slow rate. Common examples are Judaism, Hinduism, and Shintoism. Many individuals also add a third type of religious faith, those that are tribal or traditional. These animistic faiths usually believe in spirits inhabiting inanimate objects such as plants, animals, and other natural features. A religion can be either monotheistic, meaning believing in only one god, or polytheistic, which is having belief in multiple supernatural entities. Atheists, in turn, do not believe in an existence of a god or gods.

The geographic study of religion can be divided into five main themes: religious regions, religious ecology, religion and society, religious landscapes, and religious diffusion. Religious culture regions are areas that are based on religious characteristics. They can be formal regions, such as the Muslim dominated northern SUDAN, where there is a particular religion practiced. They can also be functional in nature or serve a specific administrative purpose, such as a Roman Catholic Church diocese or parish. Religious regions can be as small as a city block or can exist worldwide. Their characteristics are a result of diffusion and the interplay of religion with components of culture, society, and the environment.

### RELIGIOUS REGIONS

The most commonly described religious regions are those where a religion is practiced. Christianity is the world's largest religion in area and in the number of adherents. The faith, an offshoot of Judaism that is based on the teachings of Jesus Christ, is fragmented into numerous different denominations. The most common division is between Western and Eastern Christianity. Western Christianity is made up of the unified Roman Catholic Church and the highly divided Protestant denominations. Eastern Christianity includes groups such as Coptics, Maronites, Nestorians, and various Eastern Orthodox churches.

Christianity is almost a completely global religion but is most common in the Americas, Europe, RUSSIA, AUSTRALIA, and southern Africa. The Eastern Orthodox Church is strong in the former Soviet Union, parts of Europe, and North Africa. Roman Catholicism is concentrated in Europe and South and Middle America.



*The geography of religion looks at, maps out, interprets, compares, and analyzes various religions' origins, diffusion, subsequent distributions and effects, and the religious landscapes they create.*

Protestantism dominates much of North America but is also found in Europe.

### U.S. GEOGRAPHY OF RELIGION

The UNITED STATES has a distinctive geography of religion because of its unmatched religious diversity. Baptists and other conservative fundamentalist groups are common in the Bible Belt region in the South. Lutherans dominate most of the Upper Midwest, influenced by Scandinavian settlement of the region.

Roman Catholics are strong in the northeast United States and southern LOUISIANA but are also found in large numbers in the southwest part of the country, which has a strong Mexican influence. The Church of Jesus Christ of Latter-day Saints, or the Mormon Church, is concentrated in UTAH and other

parts of the Mountain West. Other smaller denominational religions, often at the county or local level, also exist. These “religious islands” are influenced by the presence of small ethnic groups, religious universities, and other religious group concentrations.

Islam, like Christianity, is proselytic and monotheistic. It is common in Southwest Asia, northern Africa, and parts of Southeast Asia. Its prophet, Muhammad (570?–632), gained many converts during his lifetime, but the faith has spread worldwide since his death. Today there are over 1 billion Muslims worldwide, distributed among two main divisions. Shiites constitute about 10 to 15 percent of all Muslims and are mainly found in IRAN and IRAQ. Sunni Muslims, the largest group, are common in other Muslim-dominated areas, such as North Africa.



Hinduism, which has no specific founder, is a polytheistic faith common in India. It evolved over a 4,000-year period as indigenous faiths and cultural practices merged with a religion brought to India by Aryans tribes. Today, Hinduism is made up of numerous sects and splinter groups such as Sikhism and Jainism. Perhaps the most prominent offshoot of Hinduism is Buddhism. This widespread religious faith is especially common in East and Southeast Asia. It was founded in India around 525 by Siddhartha Gautama, called the Buddha. Buddhism had the tendency to merge with native religions, and as it spread, it created divisions including Lamaism, Mahayana, and Zen Buddhism.

Another religion worthy of mention is Judaism. Associated with the Jewish people, this monotheistic, ethnic faith of many subgroups is widely dispersed across the globe in small clusters. Many Jews are found in North America and Europe. Eighty percent of the population of the country of ISRAEL is Jewish.

There are also several parts of the globe where animistic or traditional religions are found. Animism is common in less developed parts of Africa, South America, Southeast Asia, New Guinea, and Australia. What makes animism especially interesting is that each tribe has its own unique belief system that creates distinctive practices and geographies.

## RELIGIOUS ECOLOGY

The second theme of the geography of religion, religious ecology, deals with how different religions perceive and interact with their natural environments. For example, geographers analyze environmental attitudes of various faiths, because some religions appear to promote preservation and others seem to encourage environmental exploitation. Many faiths also view natural features as sacred, including rivers, forests, springs, and mountains.

For example, the GANGES and Bagmati rivers in South Asia are important to Hindus. The Jordan River around Israel, PALESTINE, and JORDAN, for example, is holy to Christians. Mt. Fuji in JAPAN is sacred in Japanese Shintoism.

Religion additionally plays a vital role in environmental perception and whether or not people view the environment as an ally or something to fear. The environment may also influence the characteristics of religious faith. While the influence of the environment on most major universal religions is less significant, it is especially visible in animism and also in terms of the philosophy of feng-shui in Chinese and Korean Buddhism. The geography of religion also concerns itself



*A Buddha in Sri Lanka dominates the local geographic landscape; Buddhism is diffused throughout the country's culture.*

with how religious belief aids in appeasing the forces of nature.

There is additionally a high level of integration between religion and society. This third theme analyzes how religious faith interacts with other components of culture. Because it is a strong human motivator at the personal and group level, religion consistently impacts other human traits, cultural group history, lifestyles, economic systems, political geography, and demography. Religion is also an important, if not the primary, component of ethnicity. For example, most Arabs are Muslim, most Mexicans are Roman Catholic, and the majority of Norwegians are Lutheran. Their religious faiths play a strong role in group identity.

Religion can also influence economic geography. For example, many religious groups have overt taboos, or the prohibition against certain items or activities.



*The Wailing Wall in Israel is a unique feature among many in the country's religious landscape.*

Caffeine is forbidden to members of the Church of Jesus Christ of Latter-day Saints and, subsequently, influences the sale of some beverages. Alcohol is forbidden to Muslims and some Christian denominations, and patterns reflecting these taboos are visible on the landscape. Religion can also influence agriculture in the absence or occurrence of certain crops and farming activities. Wine is important to Holy Communion among many Christian groups, and this has demanded a need for vineyards and grape cultivation in Christian regions. Since Jews and Muslims forbid the consumption of pork, pigs are rare in areas dominated by these two groups.

Religious faith also influences birth rates and other demographic characteristics. The Roman Catholic Church and other groups, for example, prohibit most forms of contraception and encourage large families. Such practices often increase the number of adherents and, subsequently, the spreading of the religion.

There is an increasing awareness today that religion can be frequently integrated with politics and government. Many countries are divided by religious faith, and religion is often a rallying point for political action. Religion played an important role in the partition of India in 1947 and also shaped the 20th-century geopolitics of IRELAND and its relationship with the UNITED KINGDOM. Many countries, such as Iran, are theocracies, or governments guided by a church or a religion. The Taliban, a fundamentalist Islamic group, ran AFGHANISTAN from 1996 to 2001. Some countries, including the Lutheran Norway, have an official state church. There is increasing controversy worldwide, in-

cluding in the United States, about the role of religion in government.

### PILGRIMAGES

Pilgrimages provide a unique example of how religion impacts culture and society. This act of religious devotion usually involves large numbers of people traveling in various ways to places that are often the setting of miracles, sacred physical features, or the geographic origin of a faith. A sense of duty or hope of receiving healing or a special blessing may be the motivation behind most pilgrimages. Pilgrimages are especially common among Muslim, Hindu, Shinto, and Roman Catholic adherents. They also have a significant impact on local economies and environments.

Often, religious tourism is created because so many people visit specific places. Many Roman Catholics, for example, travel to Rome, the French town of Lourdes, or the Lady of Guadalupe Shrine in MEXICO. Hindus make pilgrimages to Varanasi on the Ganges River in India. Japanese Shintos visit Ise. Perhaps the most famous pilgrimage is the hajj to Mecca in SAUDI ARABIA. The hajj is an important pillar of the Muslim faith, and it is the duty of all Muslims to travel to the city.

### RELIGIOUS LANDSCAPE

The most studied component of the geography of religion is the religious landscape, or the religious imprint on the material cultural landscape. Because there are differences in the characteristics, history, and interaction with the environment and society, religions also have distinctive landscapes. Variations in religious landscapes also give particular regions a unique character and can be seen in the form, orientation, density, and architecture of structures. The most prominent religious landscape feature is the house of worship. These church buildings, temples, synagogues, or mosques frequently have distinctive architecture based on religion. For example, it is usually easy to differentiate between an Islamic mosque and a Hindu or Buddhist temple.

Various Christian church buildings also have unique attributes. Roman Catholics usually perceive the house of worship as being the house of God, and subsequently the structures are very ornate. Most Protestant denominations view a church building as simply a place to worship and congregate. Because of this, the majority of Protestant structures are modest, smaller, and more functional than a typical Catholic church.

Some church buildings are also unique because of the congregation's ethnic background. For example,



there are often visible differences, both exterior and interior, between a German Lutheran church and an Icelandic Lutheran building.

Every religion also has its own practice for burial of the dead. Some religions, such as Hinduism and Buddhism, use cremation, so cemeteries dedicated to these faiths do not exist. Most other religions, such as Christianity and Islam, do bury their dead, but there are often differences in the architecture and orientation of grave sites. Other common man-made religious landscape features include yard and roadside shrines, religious murals and statues, and parochial schools.

It is also important to consider the symbolic and sacred qualities of the religious landscape. Why are some places special and others not? Religions often designate sacred space or features because they are worthy of devotion, loyalty, or fear, or because they have supernatural or mystical qualities. All man-made religious features can be considered sacred, but sacred space also extends to physical features such as Mt. Sinai for Judaism or Ayers Rock for Aboriginal animism in Australia.

## RELIGIOUS DIFFUSION

The fifth and final theme is religious diffusion, or the spreading of religion across space. Religious diffusion is important because the landscapes and regions that religions create are all products of spatial expansion. Geographers are interested in how religions diffuse, how they change over time, and what processes encourage these changes. Most religions have spread through contagious expansion diffusion, meaning increasing numerically through direct contact of individuals. This occurs through various conversion methods. Barriers to religious diffusion exist as well.

All religions have a source area or a hearth where their diffusion started. The most widespread religions today originate out of two primary religious hearths. The Semitic Hearth, found in Southwest Asia, is the source area of Christianity, Islam, and Judaism. Judaism started about 4,000 years ago, and Christianity evolved out of Judaism about 2,000 years ago. Islam, with its origin in the Arabian Peninsula, began approximately 1,300 years ago. Hinduism and Buddhism both originated in the Indo-Gangetic Hearth at the northern edge of the Indian subcontinent of Asia.

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## resource

THE WORD *resource* is derived from the Latin *resurgere*, meaning to "rise again." Therefore, a resource can be part of a cyclical process that can change and return over time and space. Resources are those elements that humans have the knowledge and technology to utilize to provide desired goods and services. Resources are subjective, functional, and dynamic. They can be tangible things that create, support, and supply material wealth. Resources, such as beauty, peacefulness, or diversity are considered intangible. Both tangible and intangible resources reflect variations in knowledge, technology, social structures, economic conditions, and political systems.

Humans create particular types of resources: labor, entrepreneurial skills, investment funds, capital assets, cultural adaptations, and technology. Natural resources are substances, organisms, and properties of the physical environment. These resources provide the material wealth that humans are dependent upon. Humans use many natural resources that are also important for other species.

Resources can also be considered renewable or nonrenewable. Renewable resources or flow resources naturally regenerate to provide new supplies within a human life span. These resources can be replenished or replaced continuously and sustainably into the future and faster than they can be used. Renewable resources include sunlight, biological organisms, and biogeochemical cycles that provide essential ecological services and generally will not run out.

For example, biological organisms replace themselves by reproduction; ecological processes are self-renewing. Water is considered a renewable resource. It is part of the hydrologic cycle the moves water in differ-

ent physical forms and allows for it replenishment over time and space. Humans can harvest the surplus and use it without diminishing future availability.

Nonrenewable resources or stock resources are those things that take millions of years to form and are in a fixed supply in relation to human terms. These resources may be renewed or recycled by geological or ecological processes, but the time scales are so long by human standards that the resource will be gone once present supplies are exhausted. The use of nonrenewable resources is not dictated so much by the absolute amount available but rather is due to the economic and environmental costs required to extract them. The use leads to adaptation through more efficient use, recycling, substitution of one material for another, and better extraction from other sources. Nonrenewable sources include minerals, fossil fuels, or other materials present in fixed amounts in the environment that will eventually run out.

Energy is one resource that is commonly divided into renewable and nonrenewable categories. Renewable energy includes solar, wind, tidal/wave, biomass, hydroelectricity, and geothermal energy. Solar energy is continually supplied to the Earth by the sun. Geothermal energy is continuously created beneath the Earth's surface from the extreme heat contained in liquid rock—magma within the Earth's core. Biomass describes many different fuel types from sources such as trees, agricultural wastes, fuel crops, sewage sludge and manure. Wind is created when the sun heats the Earth's surface unevenly, because of the seasons and cloud cover, causing warmer air to move toward cooler air.

Nonrenewable energy include such things as coal, petroleum, gas, and nuclear energy. Coal is a rock that is a fossil fuel formed over millions of years from decomposing plants. Another fossil fuel is petroleum, or crude oil. It is formed in a similar fashion as coal but is a liquid that became trapped between layers of rocks. Gas is trapped between layers of rock. Nuclear energy is the energy released when atoms are either split or joined together. A mineral called uranium is needed for this process. At each stage of the process, various types of radioactive wastes are produced.

Another way of understanding resource use is by viewing resources as part of a use-renewability continuum. At one extreme are naturally determined, infinitely renewable resources. The amount of these resources is unrelated to current usage levels. Examples include: solar energy, tidal and wind power, and water resources. The other extreme is where utilization ex-

ceeds regeneration. The use of the resource is consumptive, and byproducts result in unusable forms of matter and energy. Examples are fossil fuels, plants, animals, fish, forests, and soils. In between these extremes is where resource renewability is dependent on human decisions, where future supply availability is determined by usage rates and investment in artificial regeneration to ensure supply and quality (e.g., air and water quality, or minerals).

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## Rhine River

WITH A TOTAL LENGTH of 820 mi (1,320 km) flowing through SWITZERLAND, GERMANY, and the NETHERLANDS, the Rhine is the longest river in Germany and probably the most important waterway of western Europe. The Vorderhein, Hinterrhein, and Alpenrhein are the sources of the river within Switzerland. The Rhine then enters the Bodensee (Lake Constance) and reemerges as the Hochrhein up to Basel on the Swiss-German border. From Basel, it passes as the Oberrhein on the French-German border via Strasbourg/Kehl into Germany to the cities of Karlsruhe, Mannheim/Ludwigshafen, and Mainz. After Mainz, it becomes the Mittellrhein and Niederrhein and goes on via Bonn, Cologne, Duesseldorf, and Duisburg to the German-Dutch border. It terminates its route via Nijmegen at Rotterdam, the Netherlands, on the North Sea.

Flowing roughly northwest, the Rhine's annual flow at its mouth is 16.6 cubic mi (69.3 cubic km). The river is of enormous economic, cultural, and historical importance for all of western Europe. The Romans



came to the Rhine and tried to colonize parts of Germania by crossing the river, but it was in the early Middle Ages, when the new empire of Charles the Great consisted of large territories on both sides of the Rhine. These territories now form—at least in parts—FRANCE, Germany, Switzerland, AUSTRIA, BELGIUM, LUXEMBOURG, and the Netherlands. When the empire broke up after the death of Charles, two succession regions (what is today France and Germany) engaged in long-standing disputes, whereby the Rhine was a symbol as well as a catalyst.

The concept of natural borders developed under the French King Louis XIV embraced all the left (western) side of the Rhine as the French border. This strategic goal was not reached until the military successes of Napoleon Bonaparte. The French always hoped for a confederation of smaller German states on the right (eastern) side of the Rhine allied with France, which they tried to install in the early 1800s and again after 1918. These attempts failed, and since the early 19th century, German nationalism claimed the Rhine not as a border, but as an integral part of Germany on both sides of the river. German nationalists tried to establish this concept by force and with catastrophic consequences in 1870–71, 1914–18, and 1939–45. After more than 200 years of wars concerning the rule over the Rhine, this dispute was finally settled by the outcome of World War II and by the French-German friendship treaty signed by French President Charles de Gaulle and German Chancellor Konrad Adenauer in 1963.

The economic importance of the Rhine is mostly due to its role as a waterway crossing large parts of western Europe (with canals to French rivers and to the German Main and DANUBE). Due to the engineering work started by Johann Gottfried Tulla in the Grand-Duchy of Baden in the early 19th century, the Rhine is today accessible for ships from Basel via Strasbourg through all of Germany to Rotterdam and the North Sea. The economic importance led to international treaties, which were all signed in Mannheim (especially in 1831 and 1868). This waterway helped the development of all sorts of industry along the Rhine (for example: chemical industry in Basel, Strasbourg, Mannheim and Ludwigshafen; steel and coal in the parts of the Rhine near the Ruhr area). The ports of Strasbourg, Mannheim, and Duisburg are important river ports within western Europe, and the port of Rotterdam is the busiest harbor worldwide. During the last decades, environmental protection of the Rhine both for animals (especially birds and fish) and for the prevention



*The Rhine is the longest river in Germany and probably the most important waterway of western Europe.*

of floods (Rheinauen) has become a subject of international efforts and treaties.

As a historically disputed frontier, the banks of the Rhine have a great number of fortresses, especially between Mainz and Bonn in Germany. Though mostly ruins now, these structures witnessed the importance of the Rhine as a melting pot for cultural and economic traditions for more than 1,000 years. Today, the ruins, along with notable vineyards, contribute to the tourism industry. The battles of the Allied forces during World War II against Nazi Germany in the Rhine region (especially Arnheim) have contributed to the unfortunately bloody heritage of the Rhine.

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## Rhode Island

RHODE ISLAND, SMALLEST of the 50 United States at 1,214 square mi (3,144 square km), is located in New England on the ATLANTIC seaboard. It is bounded

by MASSACHUSETTS on the north and east, the Atlantic Ocean to the south, and CONNECTICUT in the west. While it is typically referred to as Rhode Island, the official name is actually the State of Rhode Island and Providence Plantations. Interestingly, nearly one-third of the state's total area, 500 square mi (1,295 square km), is water.

In 2000, the state had a population of 1,048,319, an increase of 4.5 percent since the last census in 1990. Although more than half of Rhode Island is covered with forests, it is highly urbanized. Providence is the capital and the largest city; other important cities are Warwick, Cranston, Pawtucket, and Newport. Though the population numbers may not seem big, when coupled with the state's small area, Rhode Island is the second most densely populated state with 864 people per square mi (2,238 per square km). Rhode Island was the 13th of the original 13 colonies to ratify the Constitution. It became a state on May 29, 1790.

Most of the state in the south and east can be described as part of the Coastal Lowland Region while the lands in the northwest are part of the Eastern New England Upland. The highest point is Jerimoth Hill at 812 ft (248 m) above sea level. The dominant physiographic feature of the state is the Narragansett basin, a shallow lowland area of carboniferous sediments that extends southeastward into Massachusetts.

In Rhode Island, the sediments are partly submerged as Narragansett Bay, which cuts inland for about 30 mi (50 km) to Providence. The bay contains several interesting islands, including Rhode Island (or Aquidneck), the largest and the site of historic Newport, Conanicut Island with the Jamestown Resort, and Prudence Island. Numerous sand spits and barrier beaches, in addition to small sheltering lagoons and salt marshes, mark the coastline. The general countryside contains many small lakes and a rolling hilly surface that is punctuated by short, swift streams and numerous waterfalls, all remnant of the last glaciation.

The Massachusetts Bay colony established the first settlement in the area at Providence on land purchased from Native Americans in 1636. In 1638, Puritan exiles bought the island of Aquidneck (now Rhode Island) from the Narragansetts established the settlement of Portsmouth (1638). In order to thwart claims made to the area by rivaling colonies (Massachusetts Bay and Plymouth), Roger Williams secured a parliamentary patent in 1644 and by 1647 had organized a government.

The early settlers were mostly English, with many drawn to the colony by the guarantee of religious free-

dom. The early settlers were allowed to own land that was bought from the Native Americans. Fishing and trade flourished in addition to a sound livestock industry and the more traditional agricultural products. Until the American Revolution, Newport was the commercial center of the colony, thriving on the triangular trade in rum, slaves, and molasses.

Rhode Island's traditional manufacturing economy has diversified to include important services, trade (retail and wholesale), and finance sectors. In addition, many of the traditional Rhode Island products (jewelry, silverware, textiles, primary and fabricated metals, machinery, electrical equipment, and rubber and plastic) are still being manufactured. While recent events have seen a growth in tourism agriculture has become relatively unimportant. The coastal areas are lined with resorts for swimming and boating, and windswept Block Island is a favorite vacation spot. Narragansett Bay remains famous for its sailing and yachting events, including the America's Cup yacht race that has been held in Newport several times, beginning in 1930 and most recently in 1983.

Most of the state's farmland is now used for dairy and poultry production, with Rhode Island Reds a nationally recognized brand of chickens. Commercial fishing remains important, but the industry is on the decline. U.S. naval facilities at Newport also contribute to the state's income.

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## Rhône River

THE RHÔNE IS THE chief river of southeastern FRANCE, draining much of the western ALPS and connecting the regions of the interior to the MEDITERRANEAN coast. From its rise in the Swiss Alps to its

wide DELTA, the Camargue, the river travels 500 mi (800 km), at first through narrow and twisting mountain valleys, but from Lyon to the sea (170 mi or 275 km), the river follows a nearly direct north-south line through a wide valley separating the alps from the mountains of the Massif Central. Although the river itself is too turbulent for commercial river traffic, its valley has been a thoroughfare from the MEDITERRANEAN SEA to the interior of France for centuries.

The Rhône, together with its major tributaries to the north, the Saône and the Doubs, drains a basin of 39,207 square mi (100,531 square km). It begins on the Rhône glacier (altitude 6,000 ft or 1,743 m) on the Saint Gotthard massif in southern SWITZERLAND, then travels about 90 mi (150 km) through the canton of the Valais before it enters the Lake of Geneva (Lac Léman). It exits the lake at its opposite end, passing through the center of Geneva, then winds its way through the mountainous province of Savoy, taking several sharp turns before it reaches the broad valley of the lower Rhône, where it doubles in size with the confluence of the Saône at Lyon.

Twelve cities with populations greater than 100,000 are located in this basin: Lausanne, Geneva, Lyon, Villeurbanne, Valence, and Avignon on the Rhône itself; Belfort, Besançon, and Dijon to the north in the Saône-Doubs basin; Grenoble and Annecy to the east on Alpine tributaries (Isère and Fier); and St-Étienne, which lies to the west, on the divide between the watershed of the Rhône and that of the Loire. Other major tributaries include the Arve in Switzerland, and the Ain, Ardèche, Gard, and Durance in France.

All of these rivers begin as mountain-fed streams, making the currents of the Rhône after spring melts among of the most powerful in Europe. The upper reaches of the river have therefore been harnessed for hydroelectric power—one of the largest, Génissiat, where the Rhône divides the French Alps from the Jura range (southwest of Geneva, between Savoy and southern Burgundy), was built in 1937–49, creates a reservoir 14 mi (23 km) in length, and generates about 2 million kilowatt hours annually. Other dams and barriers are important for flood control on the river's lower courses, lined with prosperous farms, orchards and vineyards.

But enough water is let through to maintain the river's other notable feature, its heavy levels of silt and mud, carried down from the mountains to the great delta of the Camargue. At 360 square mi (923 square km), the Camargue is the largest delta in western Europe. Roughly 700 million cubic ft (20 million cubic

m) of mud are deposited each year, slowly moving the coast further out into the Mediterranean (for example, the town of Aigues-Mortes was originally built on the sea, but is now 3 mi or 5 km inland). The delta is a broad plain of reed marshes and lakes, with brine lagoons cut off from the sea by sandbars, watered by two main channels, the Grand Rhône (with 85 percent of the river's flow) and the Petit Rhône. The delta has been protected as a wildlife refuge since the 1920s and is a haven for over 400 species of wild bird, notably the pink flamingo. Canals divert some of the river traffic to the larger cities of France's Mediterranean coast (Montpellier and Martigues). Other canals have been proposed to link this waterway, via the Saône, to the Rhine in northeastern France, but this has been temporarily shelved since 1997 because of environmental pressure groups. Tourism is also important to the economy of the lower Rhône basin, as visitors to France are drawn in great numbers to the Roman ruins at Orange and the Pont-du-Gard, the papal palaces of Avignon, and river sports in the gorges of the Ardèche.

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## rift valley

A RIFT VALLEY IS A trenchlike basin with steep parallel sides. The valley is essentially a down-faulted crustal block (grabben) between two parallel faults. A rift valley is different from an ordinary grabben for its remarkable length and depth. Such extraordinary basins typically occur where tectonic plates diverge. The release of Earth's interior energy creates most rift valleys in the processes of seafloor spreading or continental rifting. Igneous intrusions and volcanism accompany the rifting process.

According to the theory of plate tectonics, convective movement of material in the asthenosphere transfers Earth's interior energy to the lithosphere, causing sections of the lithosphere (plates) to rift (tear) and slide laterally. Most rifting takes place over the rising limbs of convection cells in the asthenosphere where low-density material upwells beneath the lithosphere.



Some of the rising material is molten and pushes upward into the lithosphere to form new crustal rock. The rest of the material remains in convective flow; sliding laterally until gravity pulls it into the cell's descending limb.

Rift valleys are caused by rifting continents. Continental rifting results as Earth's interior heat collects beneath a thick continental crust. Thermal expansion or swelling of the crust causes a complex system of high-elevation normal fault (grabben) valleys. The basin-and-range topography of the North American Great Basin region might represent thermal rifting of a sort that has since dissipated. As rifting proceeds, Earth's crust stretches and thins and large blocks displace along tensional fractures paralleling the rift margins. A modest amount of volcanism and igneous intrusions accompany the rifting, as magma pushes into the fractures and onto the surface. These land-based rift valleys or basins represent the first stage in the origin of an ocean basin. The best example of this initial stage is the East African rift system.

*Rift valleys on the seafloor.* As Earth's lithosphere continues to respond to driving motions in the asthenosphere, copious amounts of basaltic magma injects into the parallel tensional fissures and cools to form dense, heavy rock. The additional weight of the new rock deepens the floors of the rift valleys so that the sea inundates them. The Red Sea is a long, linear sea and is an example of this stage of rifting. The narrow basins of the Dead Sea and Sea of Galilee are continental extensions of RED SEA rifting. The broader present-day oceans are results of long-term rifting and seafloor spreading. Enormously deep rift valleys slice along the axes of huge midocean ridges where the spreading takes place. ICELAND, which is a volcanic exposure of the Mid-Atlantic Ridge, has a readily observable rift valley of this kind.

*Ancient rift valleys on passive continental margins.* Some rift valleys that formed in the initial stage of rifting remain on the margins of separating continents. Typically, these basins fill in with sediment and become parts of submerged continental shelves. However, local geological situations sometimes preserve fragments of these basins on land. The Triassic Lowland of MARYLAND, PENNSYLVANIA, and NEW JERSEY is a classic example. The Lowlands are an area of rolling land and low ridges. They are remnants of down-faulted basins produced as the supercontinent of Pangaea rifted open during the Triassic and Jurassic periods, about 200 million years ago. Similar Pangaea rift basins occur along the east coast of North America from Labrador to

GEORGIA. In their day, these basins probably resembled today's rift valleys of eastern Africa.

*Rift valleys caused by continental collisions.* Although compressional folding and thrust (reverse) faulting dominate continental plate collisions, rifting associated with normal faulting may also take place. A bulge on the edge of one of the converging continents induces rifting as it pushes into the other continent. In a complex manner, rifting on the continent with the bulge takes place, but it occurs at some distance beyond the axis of collision. In this way, relatively isolated rift valleys can form, such as the RHINE grabben in the HINTERLAND of the ALPS. The Lake BAIKAL grabben, although a great distance from the Himalayan mountain system, probably formed in the same manner.

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## Ring of Fire

The Pacific Ring of Fire is an arc of intense EARTHQUAKE (seismic) and volcanic activity stretching from NEW ZEALAND, along the eastern edge of Asia, north across the ALEUTIAN ISLANDS of ALASKA, and south along the coast of North and South America. It is made up of over 75 percent of the world's active and dormant volcanoes. The Ring of Fire is located along the borders of the Pacific Plate and other tectonic plates. It was recognized and described before the development of the relatively new and generally accepted science of PLATE TECTONICS theory.

Volcanoes are not randomly distributed over the Earth's surface, most are concentrated on the edges of CONTINENTS, along island chains, or beneath the sea, forming long mountain ranges. The peripheral areas of the Pacific Ocean Basin, containing the boundaries of several plates are dotted by many active volcanoes. More than half of the world's active volcanoes that are



above sea level encircle the PACIFIC OCEAN to form the Pacific Ring of Fire. The ring is an example of plate-boundary volcanoes. According to the theory of plate tectonics, scientists believe that the Earth's surface is broken into a number of shifting slabs or plates, which average about 50 mi (80 km) in thickness. These plates move relative to one another above a hotter, deeper, more mobile layer that moves at rates as great as a few inches per year. Most of the world's active volcanoes are located along or near the boundaries between shifting plates and are called plate-boundary volcanoes.

Some active volcanoes are not associated with plate boundaries and are called intraplate volcanoes, which form roughly linear chains in the interior of some oceanic plates. The Hawaiian Islands provide an example of an intraplate volcanic chain, developed by the northwest-moving Pacific Plate passing over an inferred hot spot that initiates magma generation and the volcano formation process.

The Ring of Fire around the Pacific represents one type of this volcanism. The chains of volcanoes in the island arcs (such as the Aleutian Islands) and continental margins (such as the ANDES) around much of the ocean form above moving oceanic plates. Plates are like giant floats on the Earth's surface, which slide next to, collide with, and are forced underneath other plates. Around the Ring of Fire, the Pacific Plate is colliding with and sliding underneath other plates.

This is called subduction and the volcanically and seismically active area is known as the subduction zone. There is a great amount of energy created by these plates; it melts rock into magma that rises to the surface as lava and forms volcanoes. Volcanoes are temporary features on the Earth's surface. There are currently about 1,500 active volcanoes in the world of which 10 percent are located in the UNITED STATES. Volcanic areas in the Ring of Fire include:

South America—the Nazca plate colliding with the South American plate has created the Andes and volcanoes such as Cotopaxi and Azul.

Central America—the small Cocos plate is moving into the North American plate, forming the Mexican volcanoes of Popocatepetl and Paricutun (which rose up from a cornfield in 1943 and instantly became mountains).

Northern CALIFORNIA and British Columbia, CANADA—the Pacific, Juan de Fuca, and Gorda plates created the Cascades and Mount Saint Helens (in Washington state), which erupted in 1980.

ALASKA—the Aleutian Islands are growing as the Pacific plate hits the North American plate. The deep

Aleutian Trench has been created at the subduction zone with a maximum depth of 25,194 ft (7,679 m).

RUSSIA's Kamchatka Peninsula to JAPAN—the subduction of the Pacific plate under the Eurasian plate formed the Japanese islands and volcanoes (such as Mt. Fuji).

The final section of the Ring of Fire exists where the Indo-Australian plate subducts under the Pacific plate and has created volcanoes in the New Guinea and MICRONESIA areas.

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## Rio Grande

THE RIO GRANDE was once known as "Rio del Norte," and the first to describe it to Europeans was Captain General Juan de Oñate, whose party of exploration first visited the river on April 20, 1598. The river was then called Corre del Norte, meaning that its current ran from the north. It is the second-largest river in North America, running more than 1,800 mi (2,897 km) from its source in the southern ROCKY MOUNTAINS in COLORADO, to Brownsville, TEXAS, where it drains into the Gulf of Mexico. Its size is exceeded only by the MISSISSIPPI-Missouri river system in the central UNITED STATES, and the Rio Grande is the predominant drainage for the state of NEW MEXICO. The river delineates the southern border of the United States from El Paso, Texas, to the Gulf of Mexico.

A systematic and careful monitoring of the movement of the Rio Grande shows that it enters New Mexico via a spectacular gorge and flows south through a series of alluvium-filled basins produced over millions of years by the rifting process. Rising at an elevation of 9,842 ft (3,000 m), the Rio Grande flows southward about 746 mi (1,200 km) to the United States-MEXICO border, separating El Paso from Ciudad Juarez, Chihuahua. From there, it flows in a more southeast

direction for approximately 1,243 mi (2,000 km), until it reaches its mouth at the Gulf of Mexico.

The Rio Grande was once useful as a major supplier of surface and ground water for residential, commercial, and agricultural use in the Albuquerque, New Mexico area and in other villages, towns, and cities of the state through which the river flows. (Its international frontier in Texas is largely devoid of urban settlement from El Paso to the more southern reaches of the valley at Del Rio and Laredo.) Due to the extensive 20th-century degradation in water quality and natural habitat—a result of its extreme subjugation to agricultural exploitation—the Rio Grande is considered one of North America's most endangered river systems.

### DEGRADATION

Being one of the longest rivers in the United States, and as an international border outside the exclusive control of any nation, perhaps it was inevitable that the Rio Grande would experience serious and uncontrolled degradation of water quality, quantity, and associated habitat. Despite the ability of the river to move about and change flow and location in its river course over most of the Rio Grande valley, it has experienced more frequent periods of stability and equilibrium as hydrological engineers have attempted to control its floods with dams and artificial lakes. Prior to this period of river engineering, riparian (riverine) ecosystems had more opportunities to become established on riverbanks and islands, and deposition and erosion of sediments allowed colonization of riparian vegetation across wide areas of the valley as it proceeded southward.

Over the course of the 20th century, the patterns of change in the Rio Grande have been radically diminished or stopped completely. It has, within the last 100 years, gone from a braided and sinuous set of channels to the flow of a single channel, in many places dredged and engineered so that it actually dries up for whole seasons, as its river waters are diverted to irrigation canals.

The Rio Grande's variegated flow over the last century has caused havoc in the Albuquerque area, as the city and its environs have suffered from major flooding. The record cites severe floods occurring on a fairly regular cycle, with major events in 1874, 1884, 1909, and 1920, to mention a few. In the 1874 flood, it was estimated that water covered 24 square mi (62 square km), filling the area between Bernalillo and Albuquerque for more than three months. While the river's ecology has been seriously compromised, it continues

to provide services to towns and farms along its course, supplying irrigation water and drainage, and recharging the Ogallala aquifer that lies beneath its route. It continues to support natural habitats, particularly *ciénega* (swamp) structures, which provide avian life with important stopovers in north-south migrations.

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## riparian

RIPARIAN IS DERIVED from the Latin *riparius*, meaning "of the river bank." The term was historically used to describe the area of land lying adjacent to a body of water: primarily streams or rivers but also lakes. Riparian areas are ecotones—transition areas or interfaces between terrestrial and aquatic ECOSYSTEMS. As such, riparian areas possess features and processes influenced by adjacent ecosystems as well as those unique to riparian habitats.

Historically, different disciplines and professions (fisheries biologists, forest managers, plant ecologists, soil scientists) have defined riparian areas in slightly different ways, emphasizing certain soil properties, plant species or communities or management goals as key characteristics. Common to most definitions, however, is that presence of water and its flow pattern or regimen—the hydrology of the system—is the key distinguishing characteristic of riparian areas. Water delivery, routing, and persistence in the soil help define the boundaries of riparian areas. Because of their position in the landscape, typically in valley bottoms adjacent to streams, riparian areas receive surface water from upland runoff and stream flooding and from subsurface groundwater flows or saturated soil horizons. Riparian areas typically have soils that are saturated by water for at least part of the growing season.

Soils in riparian areas can vary over short distances and often form a moisture gradient consisting of saturated hydric soils along streams to moderately well to well-drained soils above stream level. Decomposition

rates of organic materials (leaves, branches) vary with soil moisture in riparian areas. Decomposition is generally slower in saturated soils than in drier soils owing to cooler temperatures and reduced oxygen availability. Riparian soils are often relatively fertile due to nutrient runoff from adjacent uplands and deposition of nutrient-rich alluvial sediments by flooding.

Riparian definitions have evolved over recent years to include multidimensional considerations of ecological structure and function—an ecosystem or landscape perspective. In this regard, riparian areas are defined as three-dimensional, linear ecotones that extend longitudinally along streams and rivers, vertically from the groundwater zone below the stream channel to the vegetation canopy above, and laterally from the stream bank through the FLOODPLAIN to adjacent uplands. The width and boundaries of riparian areas are variable, influenced by the size of the water body they flank and the geomorphology of the landscape in which they are embedded. In general, riparian areas increase in width with increasing stream size and valley width and are constrained by steep slopes in mountainous areas. Thus, riparian areas along geologically constrained headwater streams in a watershed tend to be narrower in width than those along lower-elevation, low-gradient, meandering reaches at the watershed's base.

Riparian areas are among the most diverse, dynamic, and complex ecological systems in the world. The functional processes and linkages that forge riparian dynamism are a function of the interaction of aquatic and terrestrial ecosystems. Vegetation best illustrates the ecological linkage of aquatic and terrestrial ecosystems in riparian areas. Plant species diversity is often high in riparian areas because the mosaic of soil types and stream flooding disturbance (particularly scour) creates a range of soil and site conditions that favor coexistence of many different plant species in a small area. Riparian vegetation in turn influences aquatic ecosystems by shading stream channels and regulating water temperatures, by providing leaves which form the base of the stream food web, and by the input of large woody debris (logs), that affects water and sediment movement and molds in-stream habitat for aquatic organisms.

Riparian areas have important ecological functions in the landscape and are valued as buffers that protect and enhance water resources. Riparian areas may act as filters of sediments and nutrients from uplands, transformers of toxins, nutrients, and microclimate, sources of species and energy, sinks for excess nutrients, and as habitat and movement corridors for organ-

isms. Worldwide, riparian areas have been degraded by deforestation, grazing and urban development. Recognition of the important ecological functions of riparian areas has stimulated efforts to restore and enhance these diverse and dynamic systems in many areas of the world.

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## river

A RIVER IS A LARGE STREAM OF WATER flowing in a bed or channel and emptying into the ocean, a sea, a lake, or another stream. Rivers have a starting point called a source, and a mouth, where they empty into a larger body of water. Its source may be a spring, lake, or mountain snowmelt, and its ultimate destination is generally an ocean, but its mouth may empty into a lake or another river along the way. Small tributaries combine with others to create larger streams; this is repeated many times to form the large main-branch rivers that reach the sea.

Rivers are the sculptors of the landscape, shaping the Earth as they continually transport material from the land to the sea like conveyors. Some of the most permanent geographical features, they can outlive the largest mountains, watching them rise and helping to tear them down. Mountains are symbols of strength and durability, yet rivers cut through them like temporary annoyances, finding and exploiting their weak spots to plow water gaps and gouge canyons.

As the demolition of mountain ranges is taking place, so is the creation of other landforms. Sediments

carried from upstream are deposited at the river's mouth, forming a DELTA. Deltas are low, flat, and wet areas that provide much needed wetland habitat. As the river approaches the sea, it will sometimes separate into many channels forming a bird's foot delta.

The deltas of the MISSISSIPPI and NILE Rivers are good examples. Floodplains are created beside rivers when sediments are deposited by floodwater. These plains are broad, flat valleys composed of organic rich sediments, making them ideal lands for cultivation. However, repeated inundation makes them risky places for human settlement.

### CRADLES OF HUMANITY

Rivers have played an important role as cradles of human civilization. The Mesopotamians flourished along the banks of the Tigris-Euphrates. The rivers provided them with a food source, transportation, and most important, fresh water.

The Euphrates is an exotic river, or a river that flows through an arid region. In the dry climate of what is now IRAQ, the Euphrates valley was a lush oasis. Its water was not only used for drinking, cooking, and bathing, but also for the irrigation of crops and a source of fish. Canals, early pumps, and augers flooded fields with river water, enabling the desert floor and early human civilization to flourish. This happened along many other rivers as well, such as the INDUS, Nile, and the CHANGJIANG (Yangzi) and HUANG (Yellow) rivers in CHINA.

Humans have not distanced themselves from rivers in modern times. River valleys are still favored locations for population centers. America's early urban areas developed around mills and factories that harnessed the power of rivers cascading over the Piedmont. These rivers provided water, energy, and transportation to the sea. Rivers powered the INDUSTRIAL REVOLUTION in the UNITED STATES, helping to strengthen the new nation. Rivers farther west would be the arteries that helped expand it.

Transportation has always been an important use of rivers. Before jumbo jets and freeways, rivers were the world's highways. They have provided paths of exploration and trade routes of commerce. Movements of people and goods have followed river routes since the ancient Mesopotamians transported grain on reed rafts. In more recent times, rivers served as paths for exploration and expansion of the western United States. LEWIS AND CLARK used the Missouri River to travel and survey the vast lands of the LOUISIANA PURCHASE in 1804.

Robert Fulton's invention of the steamship made river travel viable upstream as well as downstream. Waterways like the Mississippi and Ohio rivers opened up world markets to formerly LANDLOCKED producers. Steamships dominated transportation for a short time in the 1800's, but were replaced by more versatile railroads.

Today, barges still carry large freight loads, but in many places rivers are now considered barriers to transportation rather than the source of it. Networks of highways and railroads can move cargo to more places in less time. After centuries of serving as essential travel routes, the river's role in transportation is quickly fading in many parts of the world. Rivers have not been treated well for their help in advancing civilization. Instead, they have been treated like prisoners and sewers. Rivers today have been polluted by industry and incarcerated by engineers. Very few remain untouched.

Pollution may be the worst illness rivers face. Chemicals from industry, waste from human settlement, and agricultural runoff have all acted to degrade the health of rivers and their ecosystems. Fish, plants and animals are not the only victims. By poisoning our fresh water supply we poison ourselves. Ignorance is the excuse of the past, and with gained knowledge and awareness, river conservation is the responsibility of all humans.

Dams and levees constrict the flow of rivers and confine them to narrow channels. Flood control structures prevent rivers from spreading over the floodplains they took several millennia to create. Natural fertilization of the plains has been restricted, forcing farmers to apply chemical fertilizers. While the frequency of floods has been reduced, the magnitude has increased. Rivers have often been compared to the human life cycle. Upper reaches of rivers are usually small, fast-moving streams that are seen as adolescents with youthful energy. In their lower reaches they become wide and slow in appearance, carrying with them the sediments and memories of the miles they've traversed. Rivers have provided us with water, power, and transportation. But those who live on their banks may argue that their most precious gift is a sense of place.

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## Rocky Mountains

THE ROCKY MOUNTAINS are a chain of mountain ranges 3,000 mi (4,800 km) long and as wide as 350 mi (563 km) running predominantly north to south in the western part of the North American continent. The Rockies run through the U.S. states of NEW MEXICO, COLORADO, UTAH, WYOMING, IDAHO, MONTANA and ALASKA, as well as the Canadian provinces of Alberta and British Columbia and the Yukon and Northwest Territories. They have been described poetically as the continent's spine.

The Rockies were originally formed approximately 100 million years ago, during the Cretaceous period, when dinosaurs still walked the Earth. There was a second period of uplift within the past 25 million years, and Pleistocene glaciers further reshaped many of the major valleys, widening and rounding their bottoms. Some small glaciers have survived high in the northern Rockies, remnants of the great Ice Age. The best known may be found in Glacier National Park in Montana on the Canadian border. Recently there has been concern that global warming is causing these glaciers to shrink and some of the smaller mountain glaciers may disappear altogether.

The Rocky Mountains are rich in wildlife to match the rugged scenery. Piñon pine and juniper are common in the southern Rockies, while they give way to firs, pines, and spruces further north. Beyond the timber line (the altitude above which trees cannot grow), mountain goats and bighorn sheep browse in alpine meadows. The forests downslope are home to bears, deer, elk, hares, minks, cougars, porcupines, squirrels, and other woodland creatures. The rivers of the region are rich with fish such as rainbow trout and grayling.

Within the Rocky Mountains lies the Continental Divide, which separates the waters that flow to the PACIFIC OCEAN from those which will flow into the ATLANTIC. The Rocky Mountains contain the headwaters of such rivers as the Arkansas and Missouri (tributaries of the MISSISSIPPI), the RIO GRANDE (which forms the border between TEXAS and MEXICO), the Colorado (which formed the GRAND CANYON and ultimately



*Many of the ranges within the Rockies are fold and fault-block mountains, but there are also extinct and dormant volcanoes.*

flows into the Gulf of Cortez) and the Columbia (principal river of the U.S. northwest).

The most famous mountain of the Rockies is Pikes Peak in Colorado, which is 14,110 ft (4,301 m) tall. Another notable mountain in the range is Cheyenne Mountain, which houses the underground command center for NORAD (the North American Aerospace Defense Command). That complex was constructed by blasting an enormous artificial cave out of the rock of the mountain and was intended to survive a direct attack by Soviet nuclear missiles.

However, most activity in the Rocky Mountains is of a more peaceful nature. Historically, mining has been the chief industry in the Rockies. The mountains contain a wealth of minerals, including gold, lead, molybdenum, silver, zinc and soda ash. Fossil fuels

such as coal, petroleum, and natural gas to fuel hungry lowland industries have also been a valuable source of wealth. Lumbering has been an important economic activity, although timber companies have moved from clear-cutting of natural growth to the managed harvesting of planted stands, making it more akin to agriculture than mining.

Agriculture in the Rockies is primarily regulated by the availability of water. Although the use of irrigation has changed the established patterns of agriculture by making water available where it was previously scarce, it has brought other problems, including water table depletion and soil salination.

Herding has been the primary form of agriculture in the high mountains, with cattle and sheep being moved between upper and lower pastures according to the seasons. Because sheep can graze far closer to the ground than cattle, there have been frequent conflicts between shepherds and cattle ranchers, who accuse sheep of destroying the range. These problems have been exacerbated in the UNITED STATES by federal government policies that permitted herders to rent federal lands for grazing at prices far below the market value of the land. In the foothills farmers raise crops that work well in small plots, especially vegetables and chili peppers.

The picturesque scenery of the Rockies make them a popular tourist destination. Yellowstone National Park, an enormous caldera volcano slumbering in the Wyoming Rockies, is famous for its hot springs and geysers as well as its abundant wildlife. The rugged mountains also make for excellent ski slopes. Well-known ski resorts in the Rockies include Vail and Aspen, Colorado; Taos, New Mexico; and Jackson Hole, Wyoming. The abundance of wildlife draws hunters and sports fishermen.

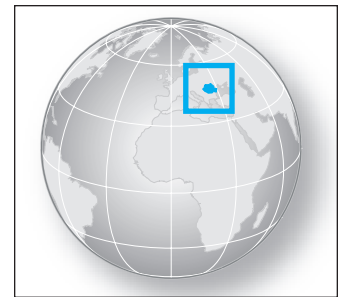
However, the growth of the tourist industry has not been without its problems. In addition to the obvious problems of environmental degradation, developments adjacent to wilderness have brought increasing conflicts with humans and wildlife. Almost invariably wildlife is the loser in the encounter, particularly when the association has led to an erosion of wild creatures' fear of humanity. Bears, cougars, and other predators come wandering through suburban developments, attacking pets and even their masters, leading to the destruction of the predator as a threat. Deer and elk crossing the highways become increasingly likely to be struck and killed by traffic, although passengers in smaller cars are also apt to suffer injuries or even death.

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## Romania

**Map Page** 1133 **Area** 91,000 square mi (237,500 square km) **Population** 22,355,551 **Capital** Bucharest **Highest Point** 8,346 ft (2,544 m) **Lowest Point** 0 m **GDP per capita** \$2,310 **Primary Natural Resources** oil, natural gas, timber, coal, iron ore.



ROMANIA IS AN OVAL-shaped country in southeastern Europe. Situated in the northeastern part of the Balkan Peninsula, it is halfway between the ATLANTIC OCEAN and the URAL MOUNTAINS and also halfway between the North Pole and the equator. It is slightly smaller than OREGON or about half the size of FRANCE.

The eastern border of Romania is the BLACK SEA. Moving in a counterclockwise direction, Romania is bordered by UKRAINE and MOLDOVA in the northeast, Ukraine in the north, HUNGARY in the west, SERBIA AND MONTENEGRO in the southwest, and BULGARIA in the south. The DANUBE river flows for nearly 900 mi (1,400 km) mostly through featureless plains on the southern and eastern border with Serbia, Bulgaria, Moldova, and Ukraine. Romania has six land regions: Dobruja, Moldavia, Bukovina, Transylvania, Walachia, and Banat.

Dobruja is the driest region of Romania. Its largest city is Constansa, located on the Black Sea. Dobruja is formed by the change in direction from east to north by the Danube River, which bends east again at its confluence with the Siretul and Prut rivers. The northern third of Dobruja is the Danube's DELTA, which borders the Ukraine. The delta is one of Europe's great marsh regions. It is now a protected BIOSPHERE.

North of Dobruja is the Moldavia region. It lies between the eastern Carpathians and the Prut River,

which borders the country of Moldova (Bessarabia). It is a plain with small hills and farmlands centered on both sides of the Siretul River and its tributaries.

Bukovina is in the highest part of the Carpathian Mountains. It is thickly forested and dotted with small villages and ski resorts. Transylvania is the largest and most varied region in Romania. It lies in the central and northwestern part of the country. The Transylvanian Plateau is a basin bordered on the east by the eastern (Moldovan) Carpathians; on the west, by the Bihor Mountains; and by the Southern Carpathians (Transylvanian Alps) on the south.

Banat lies in southwestern Romania. Bordering Hungary in the northwest, Serbia in the west and Bulgaria in the southwest, it is the region with the greatest concentration of ethnic minorities—Hungarians, Germans, and Serbs. Its major city is Timisoara. Walachia is in the south. It rises in elevation northward from its Danube River border with Bulgaria to the Transylvanian Alps. The Olt River divides Walachia into Oltenia on the west and Muntenia on the east. The Danube forms a natural boundary between Walachia and Dobruja. Bucharest is located in the center of the Muntenia on the Buflea River.

Romania's Transylvanian Alps region is famous for its stories of vampires. The Dracula castle depicted in Bram Stoker's novel *Dracula* is located at Brasov. The historical Count Dracula was Vlad Tepes ("the Impaler"), whose castle was at Targoviste.

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## rotation, Earth axis

EARTH HAS TWO primary motions: revolution and rotation. The first refers to the earth's annual orbit of the sun, which takes a bit more than 365 days per year (hence, a leap year with 366 days every four years in order to "catch up"). As it revolves around the sun, the Earth rotates on its axis once every 24 hours, a period

of time referred to as a mean solar day or sol. The axis of rotation is an imaginary line that passes through both the geographical North and South Poles.

It is important to note that the Earth's axis is tilted approximately 23.5 degrees from the ecliptic, defined as an imaginary plane described by the revolution of the earth around the sun. The direction of the Earth's rotation may be determined by viewing the Earth from a point in space above either pole.

An observer above the North Pole would note a counterclockwise motion of the Earth to the east. An observer would see a similar eastward motion over the South Pole, but from this perspective the motion would be clockwise. The eastward rotation of the Earth accounts for the apparent westward motion of the celestial bodies (sun, moon, stars) throughout the 24-hour period.

An observer in the Northern Hemisphere on a clear night can gain evidence of rotation by noting the apparent east to west movement of stars in the vicinity of Polaris, which aligns well with the Earth's axis and remains in a stationary location. The speed of the Earth's rotation varies depending on the latitudinal position of the observer. The speed is greatest at the equator where the circumference of the Earth is at a maximum. The general rule for determining the speed of the Earth at any latitude is straightforward:

$$\text{speed} = \text{circumference of latitude}/24$$

The circumference of the earth at the equator is approximately 25,000 mi (40,000 km). Applying the expression using these inputs results in a speed of 1,150 mi per hour (1,700 km per hour). At the latitudes of 90 degrees north and 90 degrees south (the poles) the speed of rotation is zero. Latitudes between the poles and the equator will have rotational speeds more than zero and less than that of the equator. Rotation should not be interpreted as a spinning motion. The Earth rotates, and even though this motion has similarities to the spinning motion of a top or a figure skater, it is not the same.

Spinning implies a rapid whirling motion not linked to a specified axis. Both the top and the figure skater spin in association with a wavering axis of motion. The Earth's rotation, on the other hand, is regular and invariably related to its clearly specified, observable, and measurable axis. The motions of revolution and rotation, both universally accepted now, were not understood until well into the 16th century. For centuries, the Ptolemaic system held that the Earth was the

center of the universe and all celestial bodies revolved around it.

### COPERNICAN THEORY

This theory held sway in the scientific world from the time of PTOLEMY throughout the Middle Ages until it was proven false in the 16th and 17th centuries. The first to proclaim that the Earth and the other planets revolved around the sun was Nicolas Copernicus, a Polish astronomer who published his theory in 1543, the year of his death. Copernicus also claimed that the Earth rotated on its axis. Additional support for Copernicus came from Johannes Kepler, a German astronomer who rejected Ptolemy's concept of circular revolution and proposed the idea of the elliptical motion of the planets. Finally, it was Galileo who demonstrated the accuracy of the Copernican theory and developed a comprehensive mathematical proof of the heliocentric system.

The Earth's rotation produces a constantly changing diurnal (daily) system of daylight and darkness, which is sensed and responded to by plants and animals alike. Rotation also produces changes in the amount of heat accumulated and lost during the 24-hour diurnal cycle. Another interesting result of rotation is the diversion of air masses in the atmosphere in predictable directions, phenomena known as Coriolis force.

Due to the Earth's rotation, high-pressure air masses in the Northern Hemisphere will be diverted in a clockwise direction, whereas low-pressure air will divert in a counterclockwise direction. These directional diversions are reversed in the Southern Hemisphere.

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## Rub' al-Khali

THE RUB' AL-KHALI (Arabic for "Empty Quarter") is located in the southern part of the Arabian Desert. The Al-Murrah Bedouin, who roam its southern edges

call it the ar-Ramlah, the "sand." It covers an area of about 250,000 square mi (647,500 square km). It is somewhat smaller than TEXAS or about as large as FRANCE together with BELGIUM and Holland.

Most of the Rub' al-Khali is in southern and south-eastern SAUDI ARABIA. It covers about a fourth of that country. It is about 700 mi (1,127 km) long east to west and about 400 mi (644 km) wide north to south. The northern boundary of the Rub' al-Khali is the central plateau (Nedj) of Saudi Arabia. While most of it is in Saudi Arabia, the southern boundary overlaps the borders of YEMEN and OMAN. In the east, the Rub' al-Khali overlaps the boundaries of the UNITED ARAB EMIRATES.

The Rub' al-Khali slopes from an altitude of about 3,300 ft (1,006 m) in the west to close to sea level in the east. The Rub' al-Khali is connected to the Nafud sand desert in northern Saudi Arabia by the Dahna belt of sand dunes. A northwesterly wind, called the shamal, shapes the dunes making them into an active sea of shifting sand. The shamal grows in force each day with the heating of the air. It also causes sandstorms in the eastern part of Saudi Arabia. During the February to March monsoon season, the wind blows mainly from the south. The wind forms the sand dunes into many shapes.

Aerial and space photography have shown that the dunes are arranged in belts, but take many shapes. In the western area of the Rub' al-Khali are many linear dunes that run for many miles in a northeast-southwest direction. In the north-central area of the Rub' al-Khali is the great Wabar impact crater created by a large meteorite. A number of meteors have been found in the vast sand dunes. The dunes in this area are also often crescent-shaped. Some of the crescent dunes have fish-hook shapes at their end or are like scimitars. Some dunes are red sand.

The eastern part of the Rub' al-Khali fills a broad, shallow basin that slopes toward the southern shores of the PERSIAN GULF. The eastern area is relatively level but covered with salt flats (*sabkhas*) in many areas. The *sabkhas* can be quagmires.

In the south, the water from the wadis flowing off the coastal plateau that borders the entire southern end of the Arabian peninsula disappears in the sands of the Rub' al-Khali. In Oman, this drainage creates a very dangerous region of quicksands and poisonous bogs called the Umm al Samim.

Most of the Rub' al-Khali is uninhabited and much of it is some of the driest land on Earth. Temperatures in the Rub' al-Khali can reach 130 degrees F (50 de-



grees C) or higher. The humidity is usually quite low. Very little fauna and flora are found in the Empty Quarter.

The rains that do fall are either in the northern area from winter rains or from monsoon rains off the ARABIAN SEA. These rains can stimulate the growth of vegetation lasting up to three years. The Rub' al-Khali was much wetter in prehistoric times. Bones of animals and flint arrowheads have been found in a number of locations. Many desert plants do grow when the rare rains come. There are also numerous insects, snakes, and other animals.

In 1992, the "Atlantis of the Rub' al Khali" was uncovered from a layer of sand. The ancient fort is believed to be the legendary lost city of Ubar. American archaeologists located the ruins with radar images taken by the ill-fated space shuttle *Challenger*. Ubar was famous in ancient times as a city of great wealth that produced frankincense.

The east area has many oil and gas fields. The al-Ghawar oil field (discovered in 1948) is one of the largest in the world. The Al-Murrah, the Rashidi, and other Bedouins have wandered the eastern region, but the advent of oil has forced the settlement of most of the Bedouin.

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## Ruhr Valley

IN TERMS OF LENGTH and volume, the Ruhr River is not one of GERMANY's major rivers. But considered as a center of economic activity, the Ruhr is among the most prominent rivers in Europe. Starting in the early 19th century, the coal that was mined in this region was processed in factories all along the river's course,

creating one of the world's largest industrial centers, notably for steel production, until coal ceased to be a dominant energy source in the second half of the 20th century.

The Ruhr Basin covers roughly 1,200 square mi (3,000 square km), from Arnsberg in the east to the river's confluence with the RHINE at Hamborn and Duisberg, overlying one of the largest coal deposits in the world. Today, the Ruhr area, or Ruhrgebiet (Ruhrpott in local slang), forms the largest conurbation in the state of Northrhine-Westphalia, consisting of ten major cities: Duisberg, Oberhausen, Bottrop, Mülheim, Essen, Gelsenkirchen, Bochum, Herne, Hagen, and Dortmund. Altogether, these cities contain about nine million people, the third-largest urban area in Europe. It is Germany's most densely populated region, stretching from the Lippe River in the north to the hills of the Bergisches Land to the south, and from the city of Hamm in the east to the Rhine River in the west.

The river itself begins in the uplands of the Sauerland, near Winterberg, and flows about 100 mi (160 km) to the Rhine. Formerly an area of small villages and pastures, far from the political and urban centers of Germany, the Industrial Revolution brought enormous changes to the area and large cities grew up nearly overnight. The area was a principal target for Allied troops in both world wars as the primary arsenal for German war machinery, the center of the "steel empires" of Krupp and Thyssen. Since the 1960s, the area has had to diversify, first toward manufacturing, then to the service and high-technology industries.

The Ruhr has been a model for eradicating air and water pollution and is today the site of numerous artificial lakes, parks, and bike trails, integrated within the highly populated residential areas. The Zollverein Coal Mine Industrial Complex in Essen, for example, once the largest and most modern colliery in Europe, was converted from a decaying facility into a modern technology museum and a monument to industrial art. A side valley in the Ruhr region has also given its name to a major chapter in human prehistory, the Neanderthal.

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## Russian Federation

**Map Page** 1118 **Area** 6.6 million square mi (17 million square km) **Population** 144 million **Capital** Moscow **Highest Point** 18,476 ft (5,633 m) **Lowest Point** -91 ft (-28 m) **GDP per capita** \$9,300 **Primary Natural Resources** oil, natural gas, coal.



STRETCHING IN A GIGANTIC arc around the ARCTIC OCEAN and North Pole, the Russian Federation spans 11 time zones, nearly half the globe from east to west. Russia is by far the world's largest country, occupying much of Eastern Europe and northern Asia. The country includes one-eighth of the Earth's inhabitable land area. The smaller European portion is home to most of Russia's industrial and agricultural activity. The URAL MOUNTAINS, which divide Europe and Asia, also separates the Great Russian Plain in the east from the West Siberian Plain.

From east to west, the land gradually rises to form the Central Siberian Plateau. In the south, the Caucasus region separates the BLACK SEA from the CASPIAN SEA. The tundra of northern Russia has scant vegetation of mostly scrub plants and lichen. South of this high Arctic zone is a great forested zone known as the TAIGA, beyond which lie the great STEPPES, or GRASSLANDS of Central Asia.

The Russian Far East is mountainous, and the KAMCHATKA PENINSULA contains active volcanoes and hot springs. Asian Russia is about as large as CHINA and INDIA combined, occupying roughly three-quarters of the nation's territory. But it is the European western quarter that is home to more than 75 percent of Russia's people.

This acutely uneven distribution of human and natural resources is one of the striking features of Russian geography. The country's terrain is diverse, with extensive stands of forest, numerous mountain ranges, and vast plains. On and below the surface the land has extensive reserves of natural resources that provide the nation with enormous potential wealth. Russia ranks sixth in the world in population, trailing China, India, the UNITED STATES, INDONESIA, and BRAZIL. The population is as varied as the terrain. Slavs (Russians, Ukrainians, and Belarussians) are the most numerous of the more than 100 European and Asiatic nationalities. Russia has borders with NORWAY, FINLAND, ESTONIA,

LATVIA, LITHUANIA, BELARUS, and the UKRAINE in the west; GEORGIA, AZERBAIJAN, KAZAKHSTAN, MONGOLIA, and China in the south; the PACIFIC OCEAN in the east, and the Arctic Ocean in the north.

Politically, the country is organized as a federation that is divided into 89 regions. The president serves as the head of state, while a prime minister serves as the head of government. In addition to the president and prime minister, leadership is managed through a bicameral legislature consisting of a Federal Assembly that represents the 89 regions and a state Duma that provides popular representation. The major cities are MOSCOW, SAINT PETERSBURG, Kiev, Minsk, Novgorod, Volgograd, Kaliningrad, Murmansk, Novosibirsk, Irkutsk, Pskov, and Vladivostok.

### GEOGRAPHIC OVERVIEW

Geographically, it has been traditional to divide Russia's vast territory into five natural zones: the tundra; the taiga, or forest; the steppe, or plains; an arid zone; and a mountain zone. In broad geographic terms, most of the Russian landscape consists of two plains (the East European Plain and the West Siberian Plain), two lowlands (the North Siberian and the Kolyma), two plateaus (the Central Siberian Plateau and the Lena Plateau), and a series of mountainous areas in the extreme northeast or intermittent scattered in pockets along the southern border. The East European Plain encompasses most of European Russia, while the West Siberian Plain (the world's largest) extends east from the Urals to the Yenisey River. Because the terrain and vegetation are relatively uniform in each of the natural zones, the Russian landscape appears to be uniform. Despite this illusion, however, Russia contains all of the major vegetation zones with the exception of a tropical rain forest.

About 10 percent of Russia's land is a treeless, marshy plain or tundra located above the ARCTIC CIRCLE. This northernmost zone stretches from the Finnish border in the west to the Bering Strait in the east before running south along the Pacific coast to the northern end of the Kamchatka Peninsula. It is an area known for its vast herds of wild reindeer, for the so-called white nights of summer (dusk at midnight, dawn shortly thereafter), and for seemingly endless days of total darkness in winter. The long, harsh winters and lack of sunshine allow only mosses, lichens, and dwarf willows and shrubs to sprout in a very narrow zone just above the barren permafrost. Although several major Siberian rivers traverse this region, their partial and intermittent thawing hampers drainage of the nu-

merous lakes, ponds, and swamps of the tundra. This is a landscape that was severely modified by glaciation in the last ice age. Less than 1 percent of Russia's population lives in this zone above the Arctic Circle. Among the regions major employers are fishing, the port industries of the northwestern KOLA PENINSULA and the huge oil and gas fields of northwestern Siberia.

The taiga, the world's largest forest region and the largest natural zone in the Russian Federation, is about equal in size to the United States. The taiga zone extends in a broad band across the country's middle latitudes, stretching from the Finnish border in the west to the Verkhoyansk Range in northeastern Siberia in the east and as far south as the southern shores of Lake BAIKAL near the Mongolian border.

Because much of the Taiga is above 60 degrees north latitude, the forest contains mostly coniferous spruce, fir, cedar, and larch, species well adapted to the long winter conditions that frequently bring the world's coldest temperatures. Isolated sections of taiga also exist along the southern part of the Urals and in the AMUR RIVER valley bordering China in the Far East. About one-third of Russia's population lives in this zone.

The steppe has long been depicted as the typical Russian landscape, although most of the former Soviet Union's steppe zone was located in what are now the Ukrainian and Kazakh republics. The much smaller Russian portion of that steppe is located mostly between those nations then extends southward between the Black and Caspian seas before blending into the increasingly desiccated territory of the Republic of Kalmykia. The steppe itself is a broad band of treeless, grassy plains that extend from HUNGARY in the west across the Ukraine, through southern Russia, and into Kazakhstan and Mongolia before ending in northeast China. Within the vast Russian landscape, the steppe provides the most favorable conditions for human settlement and agriculture because of relatively moderate temperatures and normally adequate levels of sunshine and moisture.

Russia has nine major mountain ranges, with the eastern half of the country being more mountainous than the western half. Russia's mountain ranges can be found along its continental divide (the Urals), in the Caucasus region along the southwestern border, along the border with Mongolia, and in eastern Siberia. The Urals are the most famous of the country's mountain ranges, containing quite large and valuable mineral deposits. As the natural boundary between Europe and Asia, the range extends about 1,304 mi (2,100 km)

from the ARCTIC OCEAN to the northern border of KAZAKHSTAN. From Kazakhstan, the divide continues another 854 mi (1,375 km) from the southern end of the Ural Mountains through the Caspian Sea to the CAUCASUS MOUNTAINS. In terms of elevation and vegetation, however, the Urals are far from impressive, nor do they represent any formidable natural barrier. The highest peak, Mount Narodnaya, is 6,212 ft (1,894 m), lower than the highest of the APPALACHIAN MOUNTAINS. In addition, there are several low passes that provide major transportation routes through the Urals eastward into SIBERIA.

East of the Urals is the West Siberian Plain, extending about 1,180 mi (1,900 km) from east to west and about 1,490 mi (2,400 km) from north to south. With more than half its territory below 1,640 ft (500 m) in elevation, the plain contains some of the world's largest swamps and floodplains. Most of the plain's population lives in the drier section, which is generally south of 55 degrees north latitude.

The region directly east of the West Siberian Plain is the Central Siberian Plateau, which extends eastward from the Yenisey River valley to the Lena River valley. The Yenisey valley, which delineates the western edge of the Central Siberian Plateau from the West Siberian Plain, runs from near the Mongolian border northward to the Arctic Ocean. It is also the traditional dividing line between what the Russians think of as eastern and the western Russia. The region is divided into several plateaus, with elevations ranging between 1,050 to 2,400 feet (320 and 740 m) and the highest elevation of about 5,900 ft (1,800 m) in the northern Putoran Mountains.

Truly alpine terrain can be found in the southern mountain ranges between the Black and Caspian seas. The Caucasus Mountains rise to impressive heights, forming a boundary between Europe and Asia. They also create an imposing natural barrier between Russia and its neighbors to the southwest, Georgia and Azerbaijan. One of the peaks in the range, Mount ELBRUS, is the highest point in Europe, at 18,505 feet (5,642 m), and a popular mountaineering climb. The geological structure of the Caucasus extends to the northwest as the Crimean and Carpathian mountains and southeastward into Central Asia as the TIAN SHAN and Pamirs.

The mountain systems west of Lake Baikal in south-central Siberia contain a number of ranges, with peak elevations ranging from the 10,500 ft (3,200 m) in the Eastern Sayan to 14,760 ft (4,500 m) at Mount Belukha in the Altay Range. The Eastern Sayan reach nearly to the southern shore of Lake Baikal, where they

rise impressively some 9,315 ft (2,840 m) above the water. The mountain systems east of Lake Baikal are lower, forming a complex of minor ranges and valleys that extend eastward to the Pacific coast.

Northeastern Siberia, north of the Stanovoy Range, is an extremely mountainous region. The long Kamchatka Peninsula, which juts southward into the Sea of Okhotsk, includes many volcanic peaks, more than 20 of which are still active. The highest of these is the 15,580-ft (4,750-m) Klyuchevskaya Volcano, which is also the highest point in the Russian Far East. The Kamchatka region is also one of Russia's two main centers of seismic activity (the other is the Caucasus), and earthquakes are common. In 1994, a major earthquake largely destroyed the oil-processing city of Neftegorsk.

### DRAINAGE BASINS

Russia has thousands of rivers and inland bodies of water, providing it with one of the world's largest surface-water resources. However, most of Russia's rivers and streams are part of the Arctic drainage system, extending across sparsely populated Siberia. Of the Russian rivers longer than 620 mi (1,000 km), 40 are east of the Urals, including the three major rivers that drain Siberia as they flow northward to the Arctic Ocean: the Irtysh-Ob' system, the Yenisey, and the Lena. The basins of these river systems cover about 3 million square mi (8 million square km) and discharge nearly 1.7 million cubic ft (50,000 cubic m) of water per second into the Arctic Ocean.

The northward flow of these rivers, however, means that their source waters come from areas that thaw before the areas downstream. This buildup of water each spring has created vast swamps, such as the Vasyugane Swamp, in the center of the West Siberian Plain. The same is true of other river systems, including the Pechora and the North Dvina in Europe and the Kolyma and Indigirka in Siberia. The result of all this is that approximately 10 percent of Russia's territory is classified as swampland.

A number of other rivers drain from Siberia's eastern and southeastern mountain ranges into the Pacific Ocean. The AMUR RIVER, which forms a long winding boundary between Russia and China, together with its main tributary, the Ussuri, drains most of southeastern Siberia.

Altogether, 84 percent of Russia's surface water is located east of the Urals, where the rivers flow through sparsely populated territory and empty into the Arctic or Pacific oceans. By contrast, the highest concentra-

tions of population, and therefore the highest demand for water supplies, tend to have climates much warmer than those of Siberia and thus higher rates of evaporation. As a result, densely populated areas such as the Don and Kuban river basins north of the Caucasus have barely adequate water resources.

Three basins drain European Russia. The Dnepr, which flows mainly through BELARUS and Ukraine, has its headwaters in the hills west of Moscow. The 1,155-mi- (860-km-) long Don originates in the Central Russian Upland south of Moscow and then flows into the SEA OF AZOV and the Black Sea at Rostov-na-Donu. The VOLGA is the third and by far the largest of Russia's European systems, rising in the Valdai Hills west of Moscow and meandering southeastward for 2,180 mi (3,510 km) before emptying into the Caspian Sea. With the addition of several canals, European Russia's rivers have long been linked together as part of a vital transportation system. The Volga system still carries two-thirds of Russia's inland water traffic.

Russia's other inland bodies of water are chiefly a legacy of extensive glaciation during the last several glacial periods. The most prominent of these bodies of fresh water is Lake Baikal, the world's oldest and deepest freshwater lake. Numerous smaller lakes dot the northern regions of the European and Siberian plains. The largest of these lakes are Beloye, Topozero, Vyg, and Il'men' in the European northwest and Lake Chany in southwestern Siberia. In European Russia, the largest lakes are Ladoga and Onega, both of which are northeast of St. Petersburg. A number of other smaller man-made reservoirs have been created on the Don, the Kama, and the Volga rivers to increase the water resources in those areas where population demands exceed natural capacity. There have also been many large reservoirs constructed on some of Siberia's rivers; the Bratsk Reservoir, for example, northwest of Lake Baikal is one of the world's largest.

### CLIMATE

Because climate has played such a critical role in Russia's history and development, let alone the mental image one might have, it is important to include some of its major influences. Russia has a largely continental climate because of its sheer size and compact configuration. But weather in the Northern Hemisphere generally moves from west to east.

This means that European Russia and northern Siberia lack any topographic protection from the wintertime extremes of cold air that build in the Arctic and North Atlantic oceans. On the other hand, Russia's



mountain ranges are predominantly to the south and the east, thus blocking any moderating temperatures that might move north from the INDIAN OCEAN or on-shore monsoonal flows moving inland from the Pacific Ocean. Because only small parts of Russia are south of 50 degrees north latitude and more than half of the country is north of 60 degrees north latitude, extensive regions experience six months of snow cover over subsoil that is permanently frozen to depths of several hundred meters (hundreds of feet). The average yearly temperature of nearly all of European Russia is below freezing, and the average for most of Siberia is far below freezing. The result is that most of Russia has only two seasons, summer and winter, with very short intervals of moderation between them.

The long, cold winter has a profound impact on almost every aspect of life. It affects where and how long people live and work, what kinds of crops are grown, and where they are grown (no part of the country has a year-round growing season). The length and severity of the winter, together with the sharp fluctuations in the mean summer and winter temperatures imposes special requirements on many branches of the economy.

In regions of permafrost (ground frozen throughout the year), buildings must be constructed on pilings, machinery must be made of specially tempered steel, and transportation systems must be engineered to perform reliably in extremely low and extremely high temperatures. In addition, during extended periods of darkness and cold, there are increased demands for energy, health care, and textiles. Transportation routes, including entire railroad lines, are redirected in winter to traverse rock-solid waterways and lakes.

There are some areas that represent important exceptions to this description, however. The moderate maritime climate of the Kaliningrad Oblast on the Baltic Sea has a climate similar to that of the American Northwest. And the Russian Far East, under the influence of the Pacific Ocean, has a monsoonal climate that reverses the direction of wind in summer and winter, creating sharply differentiating temperatures and extremes. There is even a narrow, subtropical band of territory on the Black Sea that is Russia's most popular summer resort area.

Because Russia has little exposure to ocean influences, most of the country receives low to moderate amounts of precipitation, a critical factor necessary for consistent agricultural production. The highest amounts of precipitation fall in the northwest, with amounts decreasing as one moves to the southeast

across European Russia. The wettest areas exist as two small pockets, a lush subtropical region adjacent to the Caucasus in southern Russia and another in the Kamchatka region along the Pacific coast.

Along the Baltic coast, average annual precipitation averages around 24 in (60 cm), while in Moscow the average is about 20 in (52.5 cm). In contrast, the area near the Russian-Kazakh border in Russian Central Asia has an average of only less than 1 in (2 cm) and there are similar measurements along Siberia's Arctic coastline. Another important indicator is the average number of days of snow cover, a critical factor for agriculture. While the actual figure depends on both latitude and altitude, it generally varies from 40 to 200 days in European Russia to 120 to 250 days in Siberia.

## NATURAL RESOURCES

Russia is one of the world's richest countries in raw materials, many of which are significant inputs for an industrial economy. Russia accounts for around 20 percent of the world's production of oil and natural gas and possesses large reserves of both fuels. This abundance has made Russia virtually self-sufficient in energy and a large-scale exporter of fuels. Oil and gas were primary hard-currency earners for the Soviet Union, and they remain so for the Russian Federation. Russia also is self-sufficient in nearly all-major industrial raw materials and has at least some reserves of every industrially valuable nonfuel mineral. Tin, tungsten, bauxite, and mercury were among the few natural materials that were imported during the Soviet period. Russia possesses rich reserves of iron ore, manganese, chromium, nickel, platinum, titanium, copper, tin, lead, tungsten, diamonds, phosphates, and gold, and the forests of Siberia contain an estimated one-fifth of the world's timber reserves.

The iron ore deposits close to the Ukrainian border in the southwest are believed to contain one-sixth of the world's total reserves. Intensive exploitation began there in the 1950s. Other large iron ore deposits are located in the Kola Peninsula, Karelia, south-central Siberia, and the Far East. The largest copper deposits are located in the Kola Peninsula and the Urals, and lead and zinc are found in North Ossetia.

## ECONOMY

For much of the 20th century, Russia had a command economy in which the government controlled every facet of economic activity. Soviet communism forbade any private property and placed farmers in collec-

tivized farms. Since the disintegration of the Soviet Union in 1991, the Russian economy has been in a difficult transition to a more free market form.

The liberalization of the economy has produced gaping inequalities between the rich and powerful few who control Russia's industries and the rest of the population who barely make enough money for subsistence. Another limiting factor is Russian infrastructure, which dates back to the Soviet era and is well behind Western standards. Russia is heavily dependent on its exports of petroleum, natural gas, timber, and metals, a condition that leads to extreme vulnerability to dramatic market changes.

Foreign investment has been difficult to attract in Russia because of uncertainties in its banking system, because of business laws that have not kept up with Western standards, and because of excesses in government corruption. Although there is still a long way to go, 2002's growth rate of 4 percent was encouraging. However, terrorism and political uncertainties continue to raise doubts over Russia's transition to a free market system.

## ECONOMIC REGIONS

The Russian Federation may be conveniently divided into 9 major economic regions: the Central European, the North and Northwest European, the Volga, the North Caucasus, the Ural, the Western Siberia, the Eastern Siberia, the Northern and Northeastern Siberia, and the Russian Far East.

The Central European area is flat, rolling country, with Moscow as its center. It forms a major industrial region for the production of trucks, ships, railway rolling stock, machine tools, electronic equipment, cotton and woolen textiles, and chemicals. The Volga and Oka rivers serve as major water routes, and the Moscow-Volga and Don-Volga canals link Moscow with the Caspian and Baltic seas. Many rail lines serve the area.

The North and Northwest European area is centered on Saint Petersburg. Here the focus is on the production of machine tools, electronic equipment, chemicals, ships, and precision instruments. The hills, marshy plains, lakes, and desolate plateaus contain rich deposits of coal, oil, iron ore, and bauxite, and the area is a prime source of lumber. The chief water routes are the Baltic-Belomor Canal and the Volga-Baltic Waterway.

The Volga region has highly developed hydroelectric power installations, including major dams at Volgograd, Kazan, Samara, and Balakovo. Farm machinery,

ships, chemicals, and textiles are all manufactured here. In addition, there are extensive oil and gas fields producing in the region. Agricultural products include wheat, vegetables, cotton, hemp, oilseeds, and fruit. Livestock raising and fishing are also important.

The North Caucasus area, descending northward from the principal chain of the Caucasus Mountains, has rich deposits of oil, natural gas, and coal. The region is an important production source for farm machinery, coal, petroleum, and natural gas. The Kuban River region is one of Russia's chief granaries. Wheat, sugar beets, tobacco, rice, and sunflower seeds are grown, and cattle are also raised. Major rivers include the Don, the Kuma, and the Terek, and the Volga-Don Canal is a major transportation route.

The Ural area, the southern half of the Ural region, has been a major center of iron and steel production in addition to producing a substantial share of Russia's oil. The region also has important deposits of iron ore, manganese, and aluminum ore.

The Western Siberian region is of growing economic importance. At Novosibirsk and Kamen-na-Obi are large hydroelectric stations. The Kuznetsk Basin in the southwest is a center of coal mining, oil refining, and the production of iron, steel, machinery, and chemicals. The area is also served by the Trans-Siberian and South Siberian rail lines, with Barnaul is a major rail junction. Agricultural products include wheat, rice, oats, and sugar beets, and livestock is raised.

Eastern Siberia, with its plateaus, mountains, and river basins, is a major source of coal, gold, graphite, iron ore, aluminum ore, zinc, and lead. There is also livestock industry, but mostly of reindeer. The regions major cities (Krasnoyarsk, Irkutsk, Ulan-Ude, and Chita) are located along the Trans-Siberian Railroad. There are also hydroelectric stations at Bratsk, Krasnoyarsk, and Irkutsk.

Northern and Northeastern Siberia covers nearly half of Russian territory. This is the least populated and least developed area. The Ob, Yenisei, and Lena rivers flow to the Arctic Ocean, but because they are frozen throughout much of the year, they provide little in the way of hydropower. Through the use of atomic-powered icebreakers, the Northern Sea Route has gained increasing economic importance. The Kolyma gold fields are the principal source of Russian gold, and industrial diamonds are mined in the Sakha Republic, notably at Mirny. Fur trapping and hunting are the chief activities in the taiga and tundra regions.

The Russian Far East, which borders on the Pacific Ocean, has the major cities of Komsomolsk, Kha-

barovsk, Yakutsk, and Vladivostok. Machinery is produced, and lumbering, fishing, hunting, and fur trapping are important. The Trans-Siberian Railroad follows the Amur and Ussuri rivers and terminates at the port of Vladivostok.

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## Ruwenzori Mountains

SHROUDED IN MISTS sitting under the hot sun of the equator is a mountain range believed to be the mysterious "Mountains of the Moon" spoken of by the ancient Greeks. Their discovery is actually credited to Henry Morton Stanley of Britain, who in 1888, while on expedition, glanced up one day and saw what the native porters at the time believed to be a mountain covered in salt.

The Ruwenzori Mountains are located on the border of UGANDA and the Democratic Republic of CONGO. Sitting between lakes Albert and Edward, they are the highest mountain range in Africa. Ten of the Ruwenzori summits are over 15,750 ft (4,800 m); the highest are Mt. Margherita, at 16,763 ft (5,109 m), and Mt. Alexandra, at 16,750 ft (5,105 m).

These mountains are a fault-block range composed of ancient crystalline rock. The Kilembe copper mine is located in the eastern foothills of the Ruwenzoris in Uganda. The vegetation of this area is profuse and prolific because of the ever-pervading cloud cover, which harbors drenching mists and rain. This Afro-alpine foliage is some of the most highly studied botany on the

continent of Africa because of its varying species and vegetation belts as one climbs higher up the peaks.

### ALPS OF AFRICA

Many of these mountains, called "the Alps of Africa," contain high mountain glacial lakes, and several have glaciers at their peaks. These glaciers have recently been the center of several studies because of their rapid rate of decline and concerns over the loss of snow on the mountain peaks. These studies have shown that some of the glaciers have receded over 1,000 ft (300 m) in the past decade alone. They also forecasted that at the present rate of global warming, all of the glaciers of the Ruwenzoris could be melted completely by 2025.

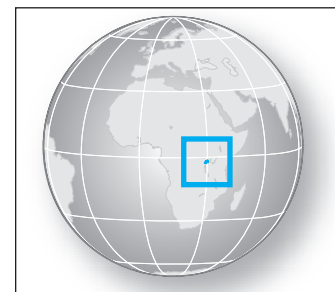
These mountains were formed in the western region of the Great Rift Valley between 40 and 10 million years ago, when the crust of the east African plateau started on a faulting process. This has taken place very slowly, only millimeters a year, to form these snow-capped equatorial mountains. Ruwenzori, unlike other surrounding areas, is nonvolcanic. These mountains are tilt-block, with steep faces on the western rift and gentler slopes running east. When these mountains tilted up out of the plains of Africa, they carried with them the metamorphosed volcanic rock with which they were formed.

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## Rwanda

**Map Page** 1114 **Area** 16,365 square mi (26,338 square km) **Population** 7,810,056 (2004) **Capital** Kigali **Highest Point** 14,826 ft (4,519 m) **Lowest Point** 3,100 ft (950 m) **GDP per capita** \$1,300 **Primary Natural Resources** gold, cassiterite (tin ore).



RWANDA, LOCATED in Central Africa, is a landlocked country of savanna GRASSLAND with a population that is predominantly rural. It is bordered by BURUNDI, the Democratic Republic of the CONGO, TANZANIA, and UGANDA.

The terrain is generally grassy uplands and hills with mountains extending southeast from a chain of volcanoes in the northwest. The climate is temperate with two rainy seasons from February to April and November to January. Frost and snow can occur in the mountainous regions. The country is troubled by the prospect of deforestation that is occurring as a result of unimpeded cutting of trees for fuel, overgrazing by livestock, overuse of farm land, and erosion. Additional environmental and climate difficulties include poaching, droughts, and volcanic activity in the Virunga Mountains.

The ethnic and cultural makeup of the Rwandan people is: Hutu, 84 percent; Tutsi, 15 percent; and Twa Pygmoid 1 percent. Rwanda is the most densely populated country in Africa. Sixty percent of the population lives below the poverty line. Estimates for life expectancy in Rwanda take into account the effects of excess mortality rates from an uncontrolled AIDS epidemic, which significantly lowers the life expectancy, causes higher infant mortality and death rates, and lowers the population and growth rates.

This has changed the distribution of population by age and sex. The current life expectancy for the total population is 39 years. Roman Catholicism is the primary religion, practiced by 56 percent of the population; Protestant, 26 percent; Adventist, 11 percent; Muslim, 4.6 percent; indigenous beliefs 0.1 percent; and 1.7 percent claim no religious beliefs. Rwanda is a poor rural country with about 90 percent of the population engaged in subsistence agriculture. The main industries include cement production, agricultural products, small-scale beverages, soap, furniture, shoes, plastic goods, textiles, and cigarettes. Agriculture products that are produced include coffee, tea, pyrethrum (insecticide made from chrysanthemums), bananas, beans, sorghum, potatoes, and livestock. Products that

are used for foreign trade are coffee and tea. The 1994 war and genocide destroyed Rwanda's already delicate economy and even further served to impoverish the population. Rwanda has made little progress in economic recovery. Despite Rwanda's fertile land, food production often does not meet the needs of population growth.

Three years before its independence from BELGIUM, in 1959, the Hutus, who are the majority ethnic group, overthrew the ruling Tutsi king. Over the next few years, thousands of Tutsis were killed, and 150,000 were driven into exile and escaped to neighboring countries. The children of these exiles later formed a rebel group, the Rwandan Patriotic Front, and started a civil war in 1990. This war, along with political and economic instability, aggravated ethnic tensions, resulting in the April 1994 genocide of roughly 800,000 Tutsis and Hutus. The Tutsi rebels defeated the Hutu regime and ended the killing in July 1994. This time, 2 million Hutus, many fearing Tutsi retribution, fled to neighboring Burundi, Tanzania, Uganda, and other countries. Subsequently, many of the refugees have returned to their homes.

Despite substantial international assistance and political reforms, including Rwanda's first local elections in 1999 and presidential and legislative elections in 2003, the country continues to be divided. Tutsi, Hutu, Hema, Lendu, and other conflicting ethnic groups, political rebels, armed gangs, and various governmental forces continue to fight, crossing into the borders of Burundi, the Democratic Republic of Congo, and Uganda to gain control over populated areas and natural resources. In spite of government and United Nations efforts to end the conflicts, localized violence continues.

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## Sahara Desert

THE SAHARA IS THE world's largest desert. Covering about 3,320,000 square mi (8,600,000 square km) it is roughly the size of the UNITED STATES. It extends across the whole of North Africa from the ATLANTIC OCEAN to the RED SEA, a distance of more than 3,500 mi (5,630 km). It stretches south for at least 1,200 mi (1,930 km).

The Sahara covers parts of the countries of MOROCCO, ALGERIA, TUNISIA, LIBYA, EGYPT, WESTERN SAHARA, MAURITANIA, MALI, NIGER, CHAD, and SUDAN. In the north, the Sahara bounds the Atlantic Ocean and the MEDITERRANEAN SEA, excluding the ATLAS MOUNTAINS in Morocco, Algeria, and Tunisia and the NILE Valley in Egypt. Some geographers include these areas. The Sahara's southern boundary is roughly on a line beginning on the Atlantic at Nouakchott (Mauritania) through Timbuktu (Mali) to KHARTOUM (Sudan) where it curves northward to the Red Sea skirting the higher elevations to the south.

South of the Sahara is an arid transition belt called the SAHEL in Arabic. It stretches across North Africa from the Atlantic to the Sudan. It is an area into which the Sahara has been slowly expanding. At the Sahara's desert edge in western Sudan is the semi-mountainous Darfur region, which is about the size of arizona and at least half of NEW MEXICO combined. Some local areas

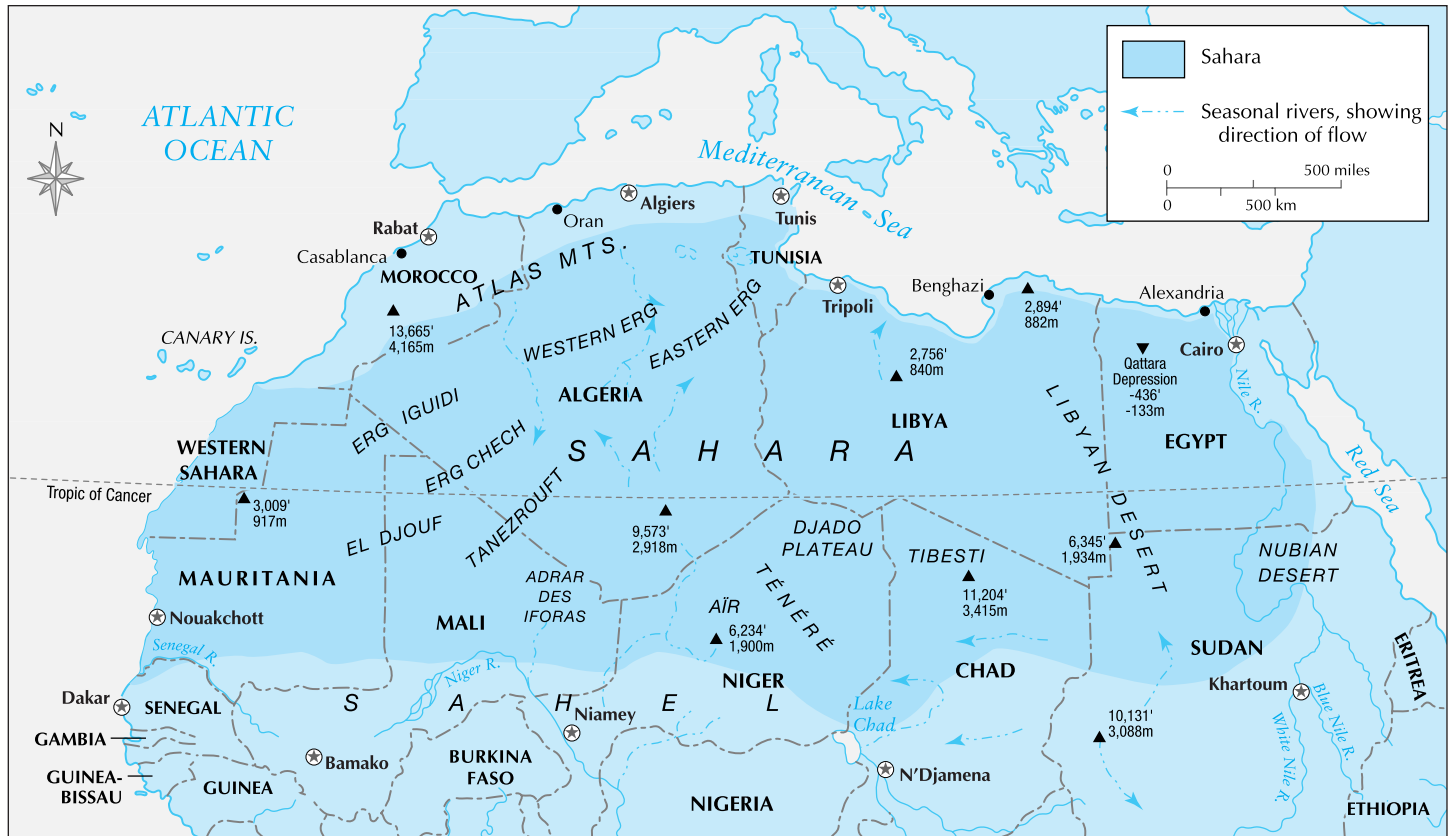


of the Sahara are also called deserts. These include the Libyan Desert in Libya, the Western Desert west of the Nile River in Central Egypt, and the Eastern Desert and the Nubian Desert (Arabian Desert) located east of the Nile.

The landforms found in the Sahara are mountains, plateaus, rocky plains, and sand dunes called ERGs. In addition, in several places there are depressions that are below sea level. Some of the depressions contain salt lakes, while others have fresh water. An important feature of the Sahara in Egypt is the Qattara Depression. This desert area is 436 ft (133 m) below sea level at its lowest point. There are several other depressions in the Sahara.

The major mountain areas are the AHAGGAR (Hoggar) MOUNTAINS in Algeria. These rise to a height of 9,573 ft (2,918 m). Northeast of the Ahaggar Mountains is an upland area called the Tassili-n-Ajjer. In the south Sahara, the Tibesti Mountains in Chad reach a height of 11,204 ft (3,415 m) at Emi Koussi. This is the highest point in the Sahara. The al-Hamra' in Libya is a region of stony desert with a pavement-like surface (hammada). Other stony plains are located in different areas.

The name *Sahara* comes from an Arabic word, *sahra*, meaning "desert." There are also local names in indigenous languages for areas such as the Tanezrouft, which is a pebbly plain in southwest Algeria, and the



Covering about 3,320,000 square mi (8,600,000 square km), the Sahara Desert is roughly the size of the United States and occupies parts of 11 North African countries, from the Red Sea to the Atlantic Ocean.

Tenere (Land of Fear) in Niger. Sand dunes (ergs, *edeyin*, or *ramlah*) cover great areas of the Sahara. The largest of these are the Great Western Erg (Algeria), Great Eastern Erg (eastern Algeria), and Erg Chech (southwestern Algeria). Other vast sand seas are in Libya and Egypt.

The Sahara is the world's driest hot desert. Some places receive an average of 4 in (10 cm) of rain a year. Most areas receive much less. Some areas may not receive any rain for 100 years or more. Rare thunderstorms occur which can have disastrous effects. Whole desert towns built from dried mud brick have been destroyed in the sudden storms. The Sahara has become much drier over the last 10,000 years. Paleolithic and Neolithic people left numerous rock carvings and paintings throughout the Sahara that show elephants, giraffes, and other animals. About 6,000 years ago, the Sahara began to dry. The forests and grasslands were replaced with barren desert. Human activity has also aided the desiccation process.

There are an estimated 2.5 million people living in the Sahara. Large areas are totally unpopulated. Most

people live in some of the mountainous areas or in the scattered oases that are found in other areas. Most are either Arabs or Berbers, like the Tuareg. The Moors are of mixed Arab and Berber blood and are mostly in northwestern Sahara. The Toubou are a Negroid people in the Tibesti Mountains.

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## Sahel

SAHEL (OR SAHIL) MEANS “edge or border” in Arabic. The Sahel is a semiarid transitional zone between the southern edge of the SAHARA DESERT and the humid savannah zone of Africa. On average it is 187 mi (300 km) wide. It has a fragile ecology but is also diverse in plant and animal species. The Sahel stretches across North Africa from the ATLANTIC OCEAN to SUDAN. Some geographers extend the Sahel to include the dry regions of ETHIOPIA, KENYA, and SOMALIA. It is a 3,107-mi- (5,000-km-) long belt of land across the entire African continent. It is an area into which the Sahara has been slowly expanding.

Where it merges with the Sahara, the rainfall drops to 7.9 in (20 cm). Where the Sahel merges with the humid savannas, rainfall has risen to 23.67 or 27.5 in (60 to 70 cm). The chief characteristic of the Sahel is its semiarid environment coupled with periodic droughts. Some geographers divide the Sahel into a broader, dryer northern zone and a wetter southern zone. The Sahel runs east and west through large parts of SENEGAL, MAURITANIA, MALI, BURKINA FASO, NIGER, NIGERIA, CHAD, Sudan, and then to the HORN OF AFRICA, including Ethiopia, ERITREA, DJIBOUTI, Kenya and Somalia. More specifically it runs through northern Senegal, southern Mauritania, to the great bend in the NIGER RIVER in Mali, then through Burkina Faso, Niger, Nigeria, Chad, and Sudan. Much of it is flat plains with great stretches located on elevated plateaus.

Beginning in the 1960s, serious droughts struck the Sahel. The area has been especially dry since 1968. Hundreds of thousands of people in the Sahel have died as a result of crop failures caused by drought. In the 1970s, the suffering of the people in the area attracted international attention.

The climate of the Sahel is normally arid. The rainfall varies, which makes agriculture difficult. Most of the vegetation is grasses and shrubs. The rain usually comes from June to September, though the average rainfall has been declining over the last five decades, which has allowed the Sahara to expand. Most of the people who live in the Sahel are nomadic herders. The drop in rainfall combined with overgrazing have contributed to increased DESERTIFICATION. Compounding the problems of the Sahel is the fact that populations are rapidly increasing. The population growth rates are some of the highest in the world. The total population of the Sahel countries is estimated to be around 50 million people excluding those counties east of Sudan. They are among the poorest in the world. The Sahel is

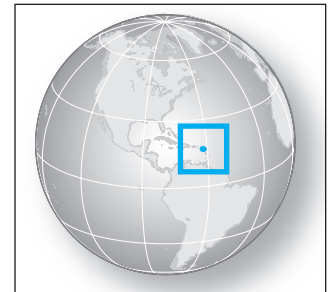
also a religious transition zone between ISLAM in the north and traditional African and Christianity in the south.

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## Saint Kitts and Nevis

**Map Page** 1137 **Area** 102 square mi (261 square km)  
**Population** 38,763 **Capital** Basseterre **Highest Point** 3,815 ft (1,156 m) **Lowest Point** 0 m **GDP per capita** \$8,800 **Primary Natural Resources** arable land, sugarcane, rice, yams, vegetables.



THE FEDERATION OF SAINT KITTS and Nevis together form one of the newest nations in the Western Hemisphere. Formerly part of the British Leeward Islands Colony, the islands achieved independence in 1983, but retain the British monarch as their sovereign and strong links with other Commonwealth nations. Saint Kitts is the larger of the two islands, separated from Nevis by a 2-mi (3-km) channel called the Narrows. The island of ANGUILLA, roughly 55 mi (90 km) to the north, was formerly administered as a dependency of the colony, but its residents chose to remain a

British dependency rather than join Saint Kitts and Nevis in independence. The people of Anguilla are not alone in the defense of their local identity, however, and calls for independence on Nevis itself were only recently defeated in a referendum of 1998. The islands have a distinctive feel from each other, with Saint Kitts being more urban, and Nevis (with only 9,000 people) retaining a quieter atmosphere.

The islands are located south of Sint Eustatius (NETHERLANDS ANTILLES), west of ANTIGUA AND BARBUDA, and north of MONTSERRAT. They were discovered by Christopher Columbus in 1493 and named for his patron saint (Saint Christopher, which became known to locals as Saint Kitts) and Santa María de la Nieves, for the clouds atop the smaller island, which appeared at first to be snow (“nieves”). Evidence of pre-Columbian settlements remain, but the islands’ native inhabitants were wiped out by European disease and conflict by the 18th century. Saint Kitts was the first British colony in the West Indies (1623) but was initially settled by both British and French planters. The islands were contested for nearly a century before being ceded formally to Great Britain in 1713, becoming the jewels in Britain’s West Indian crown.

Like most European possessions in the Caribbean, the sugar industry dominated the islands for the next four centuries and remains the main crop today, though tourism has become a larger business since the 1970s, along with some manufacturing and offshore banking. A new deepwater cruise ship berth has been built in Basseterre, promising even further development in this sector.

The islands are part of the inner arc of the Antilles island chain, which were formed by much later volcanic activity and are therefore higher and wetter than their neighbors to the east (notably Antigua). Both Saint Kitts and Nevis are fairly mountainous, consisting of a chain running the length of both islands, reaching heights of 3,815 ft (1,156 m). Mount Liamuiga (which is Carib for “fertile land”) is a dormant volcano but potentially active. Saint Kitts extends into an elongated peninsula at its southern end (called “the baseball bat”), creating almost a third island, formed around Saint Anthony’s Peak (1,053 ft or 319 m).

This southern point is also dominated by the Great Salt Pond and some of the island’s best beaches. Nevis is nearly circular and also has good beaches on all sides. The islands are about 17 percent forested. The islands are well within the dangerous hurricane belt, and suffered tremendous damage to its ports and beaches as recent as Hurricane Luis in 1995. Volcanoes, earth-

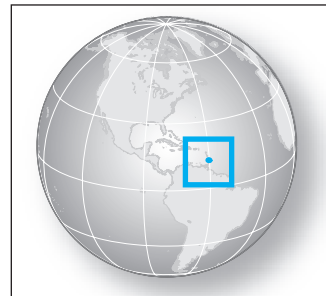
quakes and hurricanes have all affected the settlement of the islands. The main town is Basseterre, on the southwest coast of Saint Kitts, and it is relatively large by West Indian standards (15,000 in 1998). Charlestown, the main town on Nevis, is much smaller and much older than Basseterre and is one of the best preserved old towns in the Caribbean. Together, these two islands have attained one of the highest per capita income rates in the region.

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## Saint Lucia

**Map Page** 1137 **Area** 238 square mi (616 square km)  
**Population** 162,157 **Capital** Castries **Highest Point** 3,135 ft (950 m) **Lowest Point** 0 m  
**GDP per capita** \$5,400 **Primary Natural Resources** forests, minerals (pumice), geothermal potential.



THE COUNTRY OF SAINT LUCIA is the second-largest and the most picturesque of the Windward Islands. The island is known for its beauty and one of the most spectacular landscapes in the Caribbean region. Local legend attributes the name to Christopher Columbus’s discovery of the island on the feast day of Saint Lucy (December 13, 1502), though his own ships’ records do not concur. Settlement attempts were made by both Britain and FRANCE in the mid-17th century but were initially repelled by indigenous Carib Indians. Its excellent natural harbor made the island an obvious chip in the numerous treaty exchanges between Britain and France over the following two centuries, and it changed hands 14 times. As a result, Saint Lucia has one of the most mixed Anglo-French cultures of the region—Britain held the island from 1814 until



independence in 1979, but most Saint Lucians retain French customs in language and religion (the local patois language called Kweyol and Roman Catholicism).

Like its neighbors, MARTINIQUE (24 mi or 39 km to the north), and SAINT VINCENT (21 mi or 34 km to the south), Saint Lucia is volcanic in origin and maintains active zones, most notably the collapsed volcanic cone located near the town of Soufrière, the world's only "drive-up volcano," complete with boiling sulfur springs called *soufrières*. The twin peaks of Gros and Petit Piton, volcanic cones rising abruptly from the sea to heights of 2,619 and 2,461 ft (794 and 746 m) respectively, are considered among the most beautiful spots in the Caribbean.

Due to the ruggedness of the terrain, most of the island was unsuitable for development by colonial plantation ventures and therefore remains forested and attractive to tourists. Several forest reserves and coastal nature reserves have been established (mostly in the east), and scuba diving has become increasingly popular (in the western, or leeward, side of the island, sheltered from the ATLANTIC currents). Rainforests shelter wild orchids, giant ferns, and brightly colored birds, including the island's national symbol, the Saint Lucian parrot. The east coast is home to leatherbacks, or giant sea turtles, and the fer-de-lance, a snake whose bite can sometimes be fatal.

Some valleys blessed with rich volcanic soil and abundant streams, were cultivated for bananas starting in the 1920s, and exports of this fruit dominated the economy until recently. Saint Lucia has the largest banana crop in the Windward Islands, mostly headed for the UNITED KINGDOM, where the market protects many of its former colonies. But Britain's changing position in the EUROPEAN UNION (EU) and the EU's changing protection laws will affect this, leading the drive to diversify through tourism and offshore banking.

As a result, Saint Lucia today has one of the most stable and diverse economies in the Caribbean, with a range of small manufacturing industries producing items like clothing and electronic components, plus agricultural products, from limes to coconuts. Hurricanes are an annual threat, and recent devastation has highlighted this fragility: Tropical Storm Debbie wiped out about 70 percent of the banana crop in 1994, only to be followed a year later by storms Iris and Luis.

The capital, Castries, is located on the northwest coast. It was built in 1768 and named for the French minister of naval and colonial affairs. It developed as an important coaling station on the PANAMA CANAL route, and is now an oil storage and transshipment

point. Four-fifths of the town was wiped out by a fire in 1948, and much was rebuilt in concrete. The UNITED STATES established air and naval bases on Saint Lucia in World War II (primarily to protect shipping lanes to the Panama Canal) and continues to lease bases on the island. A new deepwater container port was opened at Vieux Fort at the southern tip of the island in 1993, and there are plans to establish this as a free zone for international trade.

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## Saint Petersburg

THE CITY OF SAINT Petersburg in RUSSIA is known throughout the world as one of the marvels of urban planning and magnificent architecture. As the capital of the Russian Empire from 1712 to 1918, the city was the staging ground for the dramatic events of Russian history, from Peter the Great's forced introduction of Western (modern) customs in the early 18th century to the upheavals of the Bolshevik Revolution of 1917.

Renamed Petrograd during World War I (to sound less German), then Leningrad in 1924 to honor the Soviet Union's first leader, the city has once again returned to its original name (since 1991—actually, Sankt Peterburg, from the Dutch) and once again focused itself leaning Westward in an effort to reclaim its position as a leading center for European culture. The year 2003 saw the city celebrate its 300th anniversary with exhibitions, major building renovations, and religious and civic festivals throughout the year.

Saint Petersburg is Russia's second largest city, with over 4.7 million people living in its borders. Located 400 mi (650 km) from MOSCOW, Saint Petersburg presents itself as a second capital for Russia: while Moscow is very much at the center of Russia, with train lines emanating in all directions, Petersburg is located on the far western fringe, on an outlet to the sea,

within close proximity to other European capitals in the Baltic. It was this very position, at the head of the Gulf of Finland, that led Peter the Great to undertake the massive project of building this city in the first place, his great “window on the West,” starting in 1703. The area where the Neva River flows into the gulf had only recently been taken in war against the Swedes but consisted of nothing but marshland and the remains of the fortresses of Nyen and Nöteborg. As part of his program to reform Imperial Russia by looking toward the political and cultural world of Western Europe, Peter ordered a city to be built from scratch, sparing no expense, and hiring the finest German engineers to drain the swamps and the best Italian architects to design its buildings.

### URBAN PLANNING

His passion resulted in a beautiful city, at the expense of the lives of thousands of peasant laborers. The plan drawn up by the French architect J.B. Leblond called for broad avenues and huge squares and became one of the models of urban planning for the 18th century. Because the city was built on drained swamps and numerous small islands (44 altogether), it retains hundreds of streams and canals and over 500 bridges, earning the nickname “the Venice of the North.” Huge buildings were constructed from stone, in the latest classical and Baroque styles. The most famous of these include the Peter and Paul Fortress, Saint Isaac’s Cathedral, the Winter Palace, and the Hermitage.

Nobles from across Russia were relocated to the new capital, where they built grand palaces in the city, lining the canals and grand boulevards—foremost among these is the Nevsky Prospekt (2.8 mi or 4.5 km), stretching from the Admiralty to the Monastery of Alexander Nevsky. Equally grand estates dotted the surrounding countryside, many of which continue to draw in tourists by the thousands each year: palaces like Peterhof and Tsarskoye Selo. The center of the city has recently been designated a United Nations World Heritage Site and particularly draws tourists during May and June, the time for its world-famous White Nights, when the night sky never fully darkens.

Saint Petersburg saw most of the firsts in 18th- and 19th-century Russian history: the first academy of science, the first Russian opera, the first permanent theater, and the first segment of railway in Russia, stretching 16 mi (26 km) to the suburb of Pavlovsk in 1838. As capital of the empire, it was also the site of political aggression: the Decembrist uprising of 1825; the Bloody Sunday massacre of 1905; the murder of

Rasputin in 1916; and the March and October Revolutions of 1917. During the Soviet era, Leningrad suffered from one of the most famous sieges of the 20th century, withstanding the Nazi onslaught for over two years—the 900 Days, from September 1941 to January 1944—with no outside supplies except those dropped by airlift or from trucks crossing the frozen Lake Ladoga (the famous *Doroga zhizni*, “Road of Life”).

### MODERN SAINT PETERSBURG

The modern city’s location is still its primary advantage. Traffic from the Baltic passes through Saint Petersburg up the Neva River, which connects to both Lake Ladoga and Lake Onega. From these lakes, the 19th-century Mari Canal leads to the VOLGA RIVER headwaters and therefore into the heart of Russia and beyond, as far as the CASPIAN SEA (the Volgo-Baltic Waterway). Another canal, the Baltic-White Sea Canal, was built by the Soviets to further link the city with Arctic shipping and northern ports like Arkhangel’sk. Rail links bring in grain and coal from the south as well as timber and minerals from the north, which are then exported to markets in the west. The coastal climate keeps Saint Petersburg slightly warmer in the winter than Moscow; nevertheless, ice from December to April limits shipping to narrow channels cut with ice-breakers.

Having limited resources of its own (some sand and gravel quarries and large amounts of peat), the city was dependent throughout both the Imperial and Soviet eras on the Baltic states (ESTONIA, LATVIA, and LITHUANIA) for most of its food and fuel. These two factors lie behind much of the anxiety felt by Russians, and particularly Petersburgers, toward the ever increasing independence of the Baltic states, and particularly the loss of the Kaliningrad enclave (where the deep water does not freeze). But Saint Petersburg’s regeneration as a European city is spurred by an increase in western exports of steel and electronics, supplemented by solid growth in tourism.

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## Saint-Pierre and Miquelon

AS FRENCH TERRITORIES (93 square mi or 242 square km) and a curious leftover from the chessboard games of colonial diplomacy of the 18th-century great powers, the tiny islands of Saint-Pierre and Miquelon are the only remaining fragments of the once mighty French North American empire. Consisting of two small islands, no more than barren rocks with two small settlements, the territory's small size, however, belies its importance economically as a major source for the French fishing industry.

The islands are a self-governing unit of FRANCE, known as a territorial collectivity since 1986 (a distinction that gives more autonomy). Though 3,000 mi (4,800 km) from France, its residents are full citizens of the republic, with one seat in the Senate and one in the National Assembly. Located at the intersection of the Gulf of Saint Lawrence and the ATLANTIC OCEAN, only 20 mi (32 km) southwest of the Canadian province of Newfoundland, Saint-Pierre and Miquelon are situated strategically within a day's sailing of the Grand Banks, one of the richest commercial fishing areas in the world.

The islands' 74.4 mi (120 km) of coast enable France to claim a much wider exclusive economic zone (EEZ) in the surrounding waters. Long the subject of dispute between France and CANADA, the question of fishing quotas and economic zone resulted in arbitration by a mutually agreed upon international tribunal in 1992, awarding the islands a 4,816-square-mi (12,348-square-km) exclusive economic zone, although this was only a fourth of what France was pushing for. The islands are heavily subsidized by France and are hoping to relieve some of this burden through tests for offshore oil and increased tourism, appealing to visitors' interest in natural wilderness and the islands' legendary cuisine.

The main settlement is on Saint-Pierre, the smaller of the two islands, home to 90 percent of the population. Its terrain is high and rocky, dominated by Mount Galadry. Saint-Pierre has the only harbor deep enough for seagoing vessels. Miquelon is really two islands, Grande Miquelon and Petite Miquelon (also called Langlade), connected by a narrow isthmus, a sandbar that has gradually solidified around numerous shipwrecks between the islands. The second settlement, Miquelon (population 700), is located on a narrow promontory on the far northern end of the island. Six dependent islands surround the main islands, mostly small rocks that are home to seabirds and seals.

Miquelon's southern lagoon, Grand Barachois, is also a primary breeding spot for numerous seabirds.

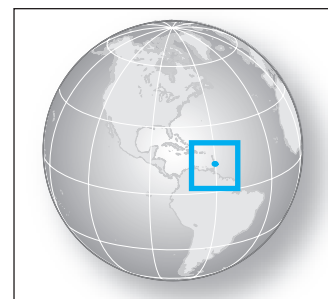
Despite its inhospitable climate—cold and wet, persistent year-round—Breton and Basque sailors attracted to the wealth of the Grand Banks settled on the islands in small numbers from the early 17th century. Others came when French colonists were expelled from Newfoundland in 1713 and Acadia in 1763. As a result of the Treaty of Paris, 1763, France ceded the entirety of its North American possessions in Canada and LOUISIANA to Great Britain, reserving only Saint-Pierre and Miquelon as a consolation prize. Much of the coastline is strewn with wreckage of ships sunk by northeast gales and fogs in this graveyard of the Atlantic.

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## Saint Vincent and the Grenadines

**Map Page** 1137 **Area** 152 square mi (389 square km)  
**Population** 116,812 **Capital** Kingstown **Highest Point** Soufrière 4,072 ft (1,234 m)  
**Lowest Point** 0 m **GDP per capita** \$2,900 (2002) **Primary Natural Resources** hydropower, cropland.



THE COUNTRY OF Saint Vincent and the Grenadines is located in the Windward Islands section of the Antilles chain, between SAINT LUCIA and GRENADA in the CARIBBEAN SEA. Unlike its neighbors, the nation consists of more than just one main island; it has over 30 smaller islands and cays, known as the Grenadines (the southernmost of these are part of Grenada). Saint Vincent has one of the most potentially dangerous active volcanoes in the Caribbean, Soufrière, on the northern end of the island, which last erupted in 1979.

The main island was named by Christopher Columbus on Saint Vincent's feast day, January 22, 1498, while the smaller islands were named (like Grenada) for the kingdom of Granada in southern

Spain, finally taken from the Moors by Columbus's patrons Ferdinand and Isabella in 1492. It consists of a chain of volcanic mountains running from north to south, surrounded by lowlands and valleys filled with fertile soil. The largest of the Grenadines are Bequia, Mustique, Canouan, Mayreau, and Union Island and are known mostly to yachtsmen and upmarket tourists from Europe. Mustique, for example, is privately owned and is home to luxury villas of royalty (the late Princess Margaret) and rock stars (Mick Jagger).

Like most of the islands in the Caribbean, colonial possession of Saint Vincent was disputed between Britain and France. It was held by Britain since 1783, but resistance to European settlement by native Caribs was stronger than on other islands. They were finally subdued by the British in 1797 and deported to the eastern coast of HONDURAS. Some later returned and were assigned to a reservation, where most native Caribs still live. Large-scale sugar plantations were introduced in the 19th century but fell into decline following a serious hurricane in 1898 and the Soufrière eruption of 1902 (within two days of the more devastating Mont Pelée on Martinique), destroying numerous plantations and killing about 1,600 people. The nation turned to cultivation of bananas as its main crop, and arrowroot, a plant used for starch and baby foods and now increasingly in demand for the production of computer paper. Saint Vincent is the world's largest producer of this crop.

Saint Vincent and the Grenadines became independent from the UNITED KINGDOM in 1979 but retains the British monarch as head of state, and remains a full member of the British Commonwealth. The capital, Kingstown, on the southern coast, is home to about a quarter of the population. About 8 percent of the population lives on the Grenadines. Attempts to follow the models of some of its neighbors in diversifying its economy through increased tourism and offshore financial services have met with limited success. The country's international reputation suffers from secrecy laws for its businesses (involving accusations of drug money laundering, and political bribery) and from its status as the largest grower of marijuana in the eastern Caribbean and as a transshipment point for South American illegal narcotics (mostly in the southern Grenadines). The country has the lowest per capita income of the Lesser Antilles.

Besides the continual threat of volcanic eruption (and accompanying earthquakes) and occasional drought, Saint Vincent frequently lies in the path of dangerous hurricanes: Allen destroyed most of the ba-

nana crop and almost all roads in 1980, while successive hurricanes in 1987, 1994, 1995, and 2002 continued to damage agricultural output. Tourism has the greatest potential for growth, thanks to mostly unspoiled and undiscovered coasts with green valleys and lush forests. Saint Vincent's rugged interior is also a potential source of hydroelectric power.

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## Sakhalin Island

SAKHALIN IS THE LARGEST island of the Russian Federation, 589 mi (948 km) long and 16 to 105 mi (25 to 170 km) wide, with an area of 24,560 square mi (78,000 square km). Sakhalin is separated from the mainland by the narrow and shallow Mamiya Strait or Strait of Tartary, which often freezes in winter in its narrower part, and from HOKKAIDŌ (JAPAN) by the Soya Strait.

The island's orography and geological structure are imperfectly known. Two parallel ranges of mountains traverse it from north to south, reaching 2,000 to 5,000 ft (600 to 1,500 m). The Western Sakhalin Mountains peak with Mt. Ichara, at 4,860 ft (1,481 m), while the Eastern Sakhalin Mountain's highest peak is Mt. Lopatin (5,279 ft or 1,609 m), which is also the island's highest mountain. Tym-Poronaiskaya Valley separates the two ranges. Susunaisky and Tonino-Anivsky ranges traverse the island in the south, while the Northern Sakhalin plain occupies most of its north.

Crystalline rocks crop out at several capes; cretaceous limestones, containing an abundant and specific fauna of gigantic ammonites, occur at Dui on the west coast; and tertiary conglomerates, sandstones, marls, and clays, folded by subsequent upheavals, appear in many parts of the island. The clays, which contain layers of good coal and abundant fossil vegetation, show that during the Miocene period Sakhalin formed part



of a continent that comprised northern Asia, ALASKA and Japan and enjoyed a comparatively warm climate. The Pliocene deposits contain a mollusk fauna more arctic than that which exists at the present time.

The island's main rivers include the Tym, 250 mi (400 km) long and navigable by rafts and light boats for 50 mi (80 km), which flows north and northeast with numerous rapids and shallows and enters the Sea of Okhotsk. The Poronai River flows south-southeast to the Gulf of Patience or Shichiro Bay, on the southeast coast. Three other small streams enter the wide semicircular Gulf of Aniva or Higashifushimi Bay at the southern extremity of the island.

Influenced by the raw, foggy Sea of Okhotsk, the climate is very cold with temperature reaching to -49 degrees F (-45 degrees C). The rainfall averages 22 in (57 cm). Thick clouds for the most part shut out the sun, while the cold current from the Sea of Okhotsk, aided by northeast winds, brings immense icefloes to the east coast in summer. The whole of the island is covered with dense forests, mostly coniferous. Bears, foxes, otters, and sables are numerous, as are reindeer in the north, and musk deer, hares, squirrels, rats, and mice everywhere. The rivers swarm with fish, especially species of salmon (*Oncorhynchus*). Numerous whales visit the seacoast. Sealions, seals, and dolphins are a source of profit.

At the beginning of the 20th century, some 32,000 Russians inhabited Sakhalin, along with several thousand native inhabitants. The island's population has grown to 673,100 today, 83 percent of whom are ethnic Russians. The native inhabitants consist of some 2,000 Nivkhs, 1,300 Ainus, 750 Orochons, 200 Evenks, and some Yakuts. The Gilyaks in the north support themselves by fishing and hunting. The Ainus inhabit the south part of the island.

The capital of Sakhalin is Yuzhno Sakhalinsk (Japanese: Toyohara), a city of about 200,000 that has a large Korean minority who immigrated to the island by their free will or were brought for compulsory service during World War II, to work in the coal mines. The 400,000 Japanese inhabitants of Sakhalin were deported following the conquest of the southern portion of the island by the Soviet Union in 1945 at the end of World War II.

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## Samarqand

SAMARQAND (SAMARKAND), the second-largest city in UZBEKISTAN, is known as the mirror of the world, the garden of the soul, the jewel of ISLAM, the pearl of the East, the center of the universe, and the city of famous shadows. In the Zerafshan Valley, with high snowcapped mountains of the Pamir-Altai mountain spurs on the northeast, it is an oasis on the edge of the Kyzyl Kum desert. The valley drew Paleolithic man 40,000 years ago, and the city site was first settled between 6000 B.C.E and 2000 B.C.E. Samarqand is as ancient as Rome and Babylon. As Maracanda, it was the capital of Sogdiana. Ethnically Iranian Tajik merchants of Sogdia plied their trade for centuries along the SILK ROAD.

Alexander the Great conquered Samarqand in 329 B.C.E. After that conquest, it became even more important as a trade center on the route between the MEDITERRANEAN SEA and CHINA. Conquest came again early in the 8th century C.E. when Arabs made it an important center of Muslim culture. In 1220, Genghis Khan and his Mongols nearly destroyed the city and many others in central Asia. The Mongol Tamerlane made it his imperial capital in 1369 and developed the city center that made it the nexus of the six points of his empire. As the empire declined into the 15th century, so did the city. Until its decline, it was the greatest Transoxianan city in numbers of people, and it led in commerce and culture because of the fertile farmland and the TRADE ROUTES that led west to Persia, south to INDIA, east to China, all meeting at Samarqand, a major city on the Silk Road.

The emir of Bukhoro conquered Samarqand in 1784. RUSSIA took it in 1868 and in 1924 made it and Bukhara, the other Tajik center, part of Uzbekistan. It served as capital of the Uzbek Soviet Socialist Republic (SSR) between 1924 and 1930.

Because it lies in the irrigated valley of the Zerafshan River, the city supports the surrounding agricultural region. It also produces motor vehicle parts, fertilizers, wine, tea, and textiles. The oldest city in Central Asia, it contains an old quarter with mosques

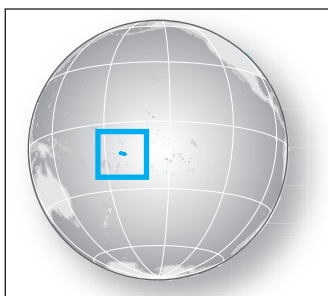
dating from the 14th and 15th centuries. In the city's center is Registan Square, which Tamerlane's grandson provided with three *madrassahs*, universities with mosques, surpassing Tamerlane's six points. It is the largest Tajik city and the major center of culture and industry for the region. Its 2000 population was 370,000.

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## Samoa

**Map Page** 1125 **Area** 1,137 square mi (2,944 square km) **Population** 178,173 **Capital** Apia **Highest Point** Mauga Silisili 6,092 ft (1,857 m) **Lowest Point** 0 m **GDP per capita** \$2,100 **Primary Natural Resources** hardwood forests, fish.



THE SAMOAN ARCHIPELAGO lies approximately midway between the Hawaiian islands and NEW ZEALAND and consists of scores of islands and atolls. Human migration into western POLYNESIA, including the Samoan archipelago, appears to date from 750 B.C.E., when scouts from the Fijian and Tongan islands arrived. Settlers soon arrived and, taking advantage of the islands' low coastal plains protected by expansive reef structures, they cultivated an array of root crops.

The interior of the larger islands is characterized by rugged mountainous terrain, some of which are actively volcanic. The rocky interior is covered by large forests and dense jungle undergrowth, leaving it both inaccessible and inhospitable for farming. The tropical climate features high temperatures year-round, with a rainy season and occasional typhoons between October and March. The greatest natural hazards are infrequent but spectacular volcano eruptions, and progressive soil erosion accelerated by the recent expansion of the hardwood industry.

In the 1870s the Samoan archipelago became enmeshed in the Great Powers' plans to expand their spheres of influence in Oceania. European planters began to seize control of the western islands in the chain, intent on developing plantations for commercial production of coconuts and copra. In the eastern half of the archipelago, the American government wanted to create a coal depot to supply its naval and merchant fleets engaged in the trade with CHINA and JAPAN. Political rivalries between opposing clans were accentuated by foreign meddling.

In 1899, to avert the possibility of war, diplomats from Britain, GERMANY and the UNITED STATES convened to partition the islands, with Germany taking control of the western sector and the United States ruling the eastern islands. At the outset of World War I, Allied troops seized German Samoa. New Zealand received a mandate from the League of Nations to oversee the islands, and in 1962 the islands became independent as Western Samoa with the capital at Apia.

Western Samoa's economy remains heavily dependent upon agricultural exports and international development aid. In many cases, remittances from family members working abroad are crucial to household income. Samoan youth regularly leave the country in search of employment. New Zealand accepts 1,100 Samoan immigrants annually, but it is believed that hundreds more enter New Zealand illegally and merge into its underground economy. American Samoa, always the smaller of the two sectors, was largely left undisturbed by Washington, D.C., until the beginning of World War II, when it became a strategically valuable outpost for American forces battling Japanese expansionism in the Pacific. Airfields, roads, and other military facilities were hastily expanded.

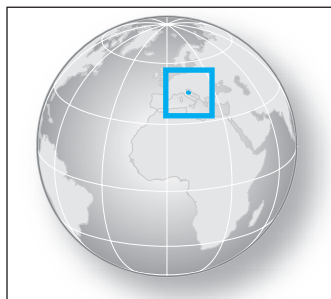
After the war, U.S. policy permitted hundreds of locals to enter the U.S. Navy, and many of these later moved with their families to America's west coast. Although a constitution was promulgated in 1960, American Samoa remains an unincorporated territory without full electoral representation in the U.S. Congress.

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## San Marino

**Map Page** 1131 **Area** 38 square mi (61.2 square km) **Population** 28,503 **Capital** San Marino **Highest Point** 2,492 ft (755 m) **Lowest Point** 182 ft (55 m) **GDP per capita** \$34,000 **Primary Natural Resources** building stone, wheat, grapes, corn.



SAN MARINO IS one of Europe's five microstates. Like the others, it is a holdover from a more fragmented European past. San Marino differs from these, however, in its claims to be the world's oldest existing republic, having never had a ruling royal family (like MONACO or LIECHTENSTEIN), looking back instead on nearly a thousand years of communal governance, and a democratic constitution written in 1601.

The country consists of one town and smaller settlements clustered around Mount Titano, one of the peaks of the Apennine mountains, not too far from the coast of the ADRIATIC SEA. The town formed around a monastery founded, according to local tradition, by a Christian stonemason named Marinus in 301 C.E. He and his followers were fleeing religious persecution from Roman authorities in Rimini and set up their own community which maintained its independence and isolation across the centuries.

The mountain refuge served as a political asylum during the upheavals of Italian unification in the 19th century, sheltering the famous patriot, Giuseppe Garibaldi. In thanks for this aid, the new Italian government promised in 1862 to respect San Marino's independence. In practical terms, however, modern San Marino is dominated politically, culturally, and economically by ITALY, which surrounds it on all sides. Nominal independence continues to give the country advantages, however, as a tax haven within the borders of the EUROPEAN UNION. Locals guard this independence, even more so in recent years. San Marino has recently started to send its own separate delegation of athletes to the Olympic Games and formally joined the United Nations in 1992.

About 20,000 Sanmarinese live in Italy or abroad, but they retain their identity, and the government even pays for them to return home for elections. Tax evasion is a bone of contention with the EUROPEAN UNION (EU), and the subject of recent agreements between the EU government and the microstates of Europe.

The republic is only 8 mi (13 km) at its greatest length, and completely dominated by its mountain, crowned by three summits, each with fortifications. Four villages nestle in valleys descending from the mountain, surrounded by what little agricultural flatland there is, where wheat, grapes and some livestock are raised. There is also some light manufacturing, producing cotton textiles, brick and tile, and pottery that is sold in countless tourist stands. It has been estimated that there are more tourist shops per capita than anywhere else in the world. Tourists and stamp collectors generate a significant amount of revenue: more than 50 percent of the GDP in 2000, generated by over 3 million visitors.

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## São Paulo

SÃO PAULO IS THE largest city in BRAZIL and serves as the capital of the state of São Paulo. With a metropolitan area population nearing 20 million at the start of the 21st century, São Paulo is the biggest city in South America and one of the fastest-growing urban areas in the world. The city is the industrial center of Brazil, located about 30 mi (48 km) inland from the city of Santos, which serves as São Paulo's ATLANTIC OCEAN port.

Jesuit missionaries founded São Paulo in 1554 as a small Native American settlement, the first in highland Brazil. The Jesuits hoped to use the settlement as a base to convert the region's native inhabitants to Christianity. The name of the city is due to the fact that they established the city on January 25, the anniversary of the conversion of Saint Paul. São Paulo grew slowly at first, reaching a population of just 300 by the end of the 16th century. The settlement gained the status of a township in 1560. In its first century of existence, there was much Native American influence in São Paulo. The basic housing structure was an indigenous-style straw-covered lodge. Residents ate local foods, slept in hammocks rather than beds, and established unions with Native American women.





*São Paulo is the biggest city in South America and one of the fastest-growing urban areas in the world.*

In 1683, São Paulo became the capital of the captaincy. São Paulo's importance grew in the 17th century, as it became the base of *bandeiras*, which were expeditions into the interior of Brazil in search of Native American slaves, gold, silver, and diamonds. Indeed, the town became the center of the native slave trade.

Authorities designated São Paulo as a city in 1711. This was a reflection of an economic shift toward southern Brazil from a gold and diamond rush. Increased trade and wealth enriched some elite residents of São Paulo. They were able to adopt more European styles in areas such as fashion, housing, and furniture. They also began to invest profits in cash crops such as coffee, which would later transform the city. Nevertheless, the city remained largely agrarian and not very prosperous compared to the much larger city of Rio de Janeiro. By the late colonial period, São Paulo had a population of 24,000, making it the third largest city in Brazil.

After Brazilian independence in 1822, the city still retained much of its colonial character. São Paulo underwent a significant transformation in the later part of the 19th century. The coffee industry came to dominate the state of São Paulo by the 1860s and 1870s, providing many jobs to the region. Numerous immigrants from Europe and elsewhere moved into the area.

The coffee industry transformed the city, which greatly benefited from the economic boom. By the 1870s, the provincial government spent half of its budget on the city of São Paulo. Authorities spent most of the money on urban improvements that benefited

the city's wealthy residents. The middle and lower classes meanwhile saw little improvement. On the contrary, the number of poor residents grew, many of whom lived in tenements known as *cortiços*. As a result of the prosperity and immigration created by coffee, the city of São Paulo began to grow and industrialize. Between 1880 and 1900, the city's population grew from 35,000 to 240,000, reaching annual growth rates as high as 14 percent in the 1890s. Some in São Paulo also began to reinvest coffee profits in factories and the city soon became the country's key industrial center. At the same time, there was already evidence of haphazard construction, poor sanitation, and a lack of adequate public services.

By the early 20th century, the city possessed many textile mills, shoe factories, and other industries. Heavy industry appeared by the time of World War II. In the post-war era, many international automobile companies such as Ford, General Motors, and Volkswagen established plants in the São Paulo metropolitan area. Thus, the city's working class continued to grow in importance. In fact, São Paulo's workers played an important role in bringing about the end of military rule in Brazil in the 1980s. The city's working class, with the support of the Catholic Church, challenged the power of the military government through a series of strikes.

While in the late 19th century São Paulo had only about 10 percent of the population of Rio de Janeiro, Brazil's largest city, by 1970 it had become the biggest urban area in the country. This rapid growth in the 20th century brought with it many urban problems. São Paulo's economy could not absorb such an influx of new inhabitants. Many residents are therefore unemployed or underemployed. Shantytowns known as *favelas* have grown up around the city. Traffic congestion on São Paulo's streets has become a major problem, and noise and air pollution plague the city's residents.

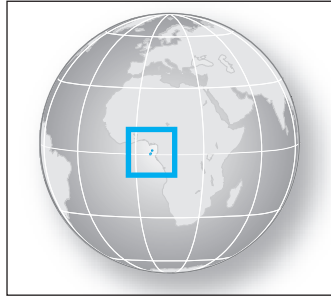
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## São Tomé and Príncipe

**Map Page** 1115 **Area** 386 square mi (1,001 square km)  
**Population** 175,883 (2000)  
**Capital** São Tomé **Highest Point** 6,640 ft (2024 m)  
**Lowest Point** 0 m **GDP per capita** \$1,200 **Primary Natural Resources** bananas, cocoa, coconuts, coffee, fish.



ONE OF AFRICA'S smallest countries, the Democratic Republic of São Tomé and Príncipe consists of two main islands (São Tomé and Príncipe) of volcanic origin with some smaller islets. São Tomé lies approximately 180 mi (289 km) from the coast of GABON and is crossed by the equator at the island's southern tip. Príncipe is located about 160 mi (257 km) from the coast of EQUATORIAL GUINEA. São Tomé's geography consists of a dense and mountainous jungle, where large plantations have been established that produce sugar, coffee, and cocoa. Príncipe consists of sharp mountains. Other islands included in the republic are Pedras Tinhosas and Rolas.

The climate is tropical with two rainy seasons in March and September. Discovered and claimed by PORTUGAL in 1470 to 1477, the islands' history of occupation and development is nontraditional and has impacted current economic status and development efforts. When the Portuguese explorers discovered the islands, they claimed to find no inhabitants, and as a result, the islands became an essential point in the slave trade. With the influx of slave labor, a plantation-based economy was established. People were brought as slaves from a number of different countries (BENIN, Gabon, CONGO, ANGOLA, MOZAMBIQUE, CAPE VERDE). Over time, the slave population was further divided between those working on the plantations of São Tomé and those working on Príncipe.

Intensive cultivation of the land by slave labor made the islands a major producer of sugar during the 17th century, but production declined until the mid-1800s, when sugar cane was replaced by new crops of cocoa and coffee, which brought new prosperity to the islands. The islands of São Tomé and Príncipe were the world's largest producer of cocoa in 1908, and the cocoa crop is still the most important today. Working conditions for laborers were inhumane, and in 1909, British and German chocolate manufacturers boycotted the São Tomé cocoa industry in protest.

The political history of the islands was stable until recently. From the discovery of the Islands until 1975, the Portuguese were in charge of the government. After an unsuccessful revolt in 1953, the citizens of the islands continued to request independent rule from Portugal. On July 12, 1975, this request was granted, and Manuel Pinto da Costa, leader of the only legal political party (Movement for the Liberation of São Tomé and Príncipe, MLSTP), became president and Miguel Trovoada, prime minister. Da Costa ruled the islands from 1975 to 1991.

Protests rose throughout the 1990s over unemployment and high inflation. Businessman Fradique de Menezes, a wealthy cocoa exporter, was elected to the presidency in July 2001 with 65 percent of the votes. De Menezes, the son of a Portuguese father and São Tomeari mother, became the country's third president. A military coup in July 2003 attempted to overthrow his government while the president was on a private visit to NIGERIA. Major Fernando Pereira, head of the country's military school, seized power, but resigned a week later under international pressure and de Menezes returned to the position of president. Eventually, de Menezes returned to São Tomé after an agreement to reestablish democratic rule was reached with the coup leaders.

In the 1990s, the government initiated a process of land tenure reform and privatization, which has resulted in a mixture of small, medium, and large land holdings. The country's economy had become increasingly dependent on cocoa since its independence, and in the 1990s cocoa production had reached its lowest level from drought and mismanagement. However, the redistribution of the land holdings assisted in strengthening the cocoa prices, which helped improve export earnings.

The recent discovery of oil in the Gulf of Guinea is likely to have a significant impact on the country's economy as São Tomé and Príncipe have been attempting to reduce their dependence on the cocoa crop. The government has been encouraging economic diversification and is set to exploit oil off the country's coast.

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## Sargasso Sea

THE SARGASSO SEA is located in the North ATLANTIC OCEAN. The area of the sea is found between 20 degrees N and 35 degrees N latitude and 30 degrees W and 75 degrees W longitude—the hump extending northward of BERMUDA. This is also known as the “horse latitudes.” The Sargasso Sea, relatively calm and motionless, is unique, as it has no boundaries or coastline. It is completely surrounded by waters of much faster ocean currents: the anti-cyclonic current system formed by the GULF STREAM, the Canaries current, and the equatorial current. On the west the boundary follows the coast of North America as far as 40 degrees N. The sea depth varies from 5,000 ft to 23,000 ft (1,500 to 7,000 m). It is a vast 2 million square mi (5.2 million square km) ellipse or oval-shaped mass of deep blue waters and spins in a clockwise direction. Sargasso Sea drifts and the changing ocean currents determine its location. The boundary shifts mainly from the force of the gulf stream. There is no similar phenomenon in other oceans.

Clear warm waters and large quantities of floating Sargasso or gulf weeds characterize the sea. The Portuguese word *sargasso* means “seaweed.” Sargassum is a brown algae with slender stalks, leaflike branches, and a glass bladder, which helps in supporting the stalks by serving as a float. It is normally attached to fixed objects on the bottom but often breaks loose and drifts into the Sargasso Sea. The algae that riddles its surface is actually a deceptive lush veneer to a stretch of ocean that is relatively devoid of life at deeper levels. The gulf weed is a floating plant without any roots. It is a type of LITTORAL flora that is isolated from the coast and has adapted itself in the new environment. The winding bands of water with floating weeds look like plankton rivers. The weeds occur in scattered masses of 100 ft (30.5 m) in diameter. The central part of the ocean possesses thickest weeds. It is estimated that the weed is spread over 2 million square mi (5.2 million square km). Perhaps the weed beds of the West Indies are the ultimate source of these weeds.

Because of its stillness and seaweeds on the surface, the Sargasso Sea is a fascinating ECOSYSTEM. Marine biologists have called it a biological desert, largely devoid of plankton, a basic food supply for fish. It lacks the nutrients necessary to support large fishes. Even in the ocean desert, though, there is an intricate web of life that has adapted to existence among the weeds. The sea is abundant in smaller marine animals such as shrimps, small crabs, and octopi. Much of this marine

life is directly dependent on the floating seaweed. Sargassum, a common frogfish, lives amid floating masses of sargassum seaweeds. These fish have developed an art of camouflage to the point where the fish is practically indistinguishable from surrounding seaweeds. The saline waters of the Sargasso are the breeding grounds of eels. Eels from thousands of miles away in North America and Europe swim here to mate and lay eggs. After the eel larva hatch, they make the long swim back. Sea birds are absent in this area, as their prey finds suitable hiding places among the weeds. The atmospheric temperature in this part of the Atlantic is higher—about 78 degrees F (26 degrees C), which helps in the process of evaporation. The higher salinity of Sargasso Sea is attributed to high temperature and greater evaporation and lack of mixture of fresh water by rivers or ice water.

Christopher Columbus, who crossed it on his initial voyage in 1492, first mentioned the Sargasso Sea that encompasses the Bermuda islands. Because the sea is very calm with little wind, sailors since the time of Columbus mistakenly thought that seaweed itself is what trapped their ship. The mysteries of abandoned floating ships are associated with Sargasso Sea. There is no foundation to the belief that the amount and thickness of the weed can hinder a ship. The famed and feared Bermuda Triangle lies within the Sargasso Sea. The mystery of the Sargasso Sea was merely transposed later through the Bermuda Triangle.

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## satellites

THE GLOBAL POSITIONING System (GPS) is a constellation of earth-orbiting satellites developed by the U.S. Department of Defense to provide global, all weather and 24-hour positioning capabilities to ground-based GPS receivers. Although the original system was intended for military use, it has also found important and widespread applications in civilian positioning, navigation, and mapping. Positioning is

about determining an exact location based on a coordinate referencing system. Navigation is the process of moving from one location to a destination and knowing at each stage the current position with respect to the destination. Hence a route is a series of waypoints tracing out the path from the initial location to the destination. GPS is also increasingly used as data input in GEOGRAPHIC INFORMATION SYSTEMS (GIS) for accurate positioning of geospatial map data and for the collection of field data. Effective use of a GPS receiver does not require an understanding of the technical details, but does require some training and an appreciation of the limitations of the system as a whole. GPS technology is collectively composed of a space segment, a control segment, and a user segment.

The space segment of the system consists of 27 GPS satellites orbiting the Earth at a distance of about 12,427 mi (20,000 km) above the surface. Twenty-four of these satellites are active, while three serve as replacement in case of failure. The satellites are positioned in six evenly spaced orbital planes and make two complete rotations each day. With this arrangement, at least four and as many as eight GPS satellites can be detected above the horizon from any location on the surface. Each satellite has an expensive atomic clock that generates precise time, which together with its orbital location information, is broadcast to ground receivers along two coded carrier signals. Using a three-dimensional mathematical process called trilateration, the location of the ground GPS receiver can be determined if its distance from four satellites is known. The GPS receiver automatically calculates the distances to each satellite using the travel time information encoded in the detected signals and the speed at which the signal travels ( $3 \times 10^8$  ms<sup>-1</sup>). The GPS receiver does not contain an atomic clock to measure time differences precisely but uses instead an internal database called an almanac. The almanac gives the projected position of each satellite in its orbital plane from which time differences and the distance to the satellites can be determined. The almanac of GPS receivers is constantly updated by the satellites to adjust for any changes in predicted orbital positions.

The control segment consists of a network of tracking ground stations that measure the satellite signals, evaluate orbital information, and upload maintenance data to the GPS satellites. The user segment consists of the GPS receivers and the user community. The GPS receiver is designed as a rugged and portable device with a small viewing screen and user controls and an antenna to receive the signals from the orbiting satellites.



*An artist's rendering shows one of the 27 Global Positioning System satellites in orbit above the Earth.*

For accurate positioning, it is recommended that the antenna of the receiver has a clear view of the sky. When the receiver is turned on, the unit takes some time to locate the satellites and to process the received information before the GPS unit location is fixed or known. In technical terminology, this fixed position is referred to as a waypoint and can be recalled for further use and analysis.

The positional accuracy that is achieved from GPS receivers depends on a number of factors. The U.S. military uses an encrypted code on one of the two GPS satellite broadcast frequencies to obtain location accuracies on the order of  $\pm 2$  m on hand-held receivers. This is called the Precise Positioning Service (PPS). The broadcast signal code used by civilian GPS units is randomly degraded and scrambled (a process called Selective Availability, or SA) such that location accuracies are approximately on the order  $\pm 50$  m. This is called the Standard Position Service (SPS) and is freely available to anyone with a GPS receiver unit. In 2000, commercial interests were successful in ending the SA policy with the result that civilian GPS devices now provide location information to the order of  $\pm 5$  m. But there is the risk that the SPS can be again degraded or completely turned off during times of US national and global security risks, rendering civilian GPS units unreliable.

Hence, it is not advisable to depend solely on a GPS unit for navigation and other mission critical uses.



Positional accuracy can also be affected by the quality and number of receivers, the number of satellites that are detected from a location, and the time taken to establish a fix. The use of multiple receivers in an approach called relative or differential positioning can greatly improve positional accuracy and overcome the problems associated with select availability. In this approach, a fixed receiver, called the base station, is positioned at a point whose coordinate is accurately known, and a mobile GPS unit is used in the field. The base station corrects with the aid of computer software tools all signals received from the GPS satellites for biases caused by clock errors, atmospheric delays, and selective availability. The base station then transmits this locally adjusted data to the mobile unit, thereby updating the relative location of the mobile unit. Accuracies on the order of centimeters can be achieved with this approach and is used predominantly in land surveying and geodesy.

Using GPS data is a relatively simple operation. Once the GPS unit receives the signals from at least four satellites and integrates that information with what is held in its electronic almanac, calculations about latitude, longitude, and altitude of the GPS unit is automatically made. The location information is based on the World Geodetic System 1984 (WGS 84) reference, which provides a standardized frame of reference so that the measurements from different GPS units are comparable. This location data is displayed on the small screen of the GPS unit using digital map files that are stored in memory. If the unit moves from this location, the “fixing” process will be repeated and a path traced out based on the changing location.

Options such as connecting to external maps, or simply saving and downloading the coordinate information for later integration with maps, are possible. The distance and time traveled, speed, and estimated times to reach some identified destination are some of the information that can be obtained by using a GPS receiver. With the increasing use of GPS units in everyday utilities (such as cars and telephones), the technology and its improvements will be a guiding force well into the next century.

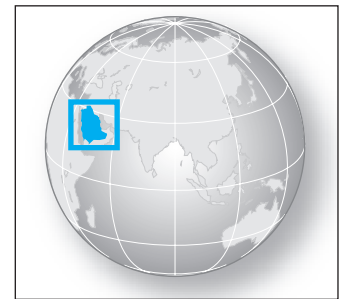
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## Saudi Arabia

**Map Page** 1122 **Area** 756,984 square mi (1,960,582 square km) **Population** 24,293,844 **Capital** Riyadh **Highest Point** 10,278 ft (3,133 m) **Lowest Point** 0 m **GDP per capita** \$11,400 **Primary Natural Resources** petroleum, natural gas, iron ore, gold.



LOCATED ON THE ARABIAN Peninsula in the MIDDLE EAST between the ARABIAN SEA, the RED SEA, OMAN, YEMEN, the UNITED ARAB EMIRATES, IRAQ, and KUWAIT, the country of Saudi Arabia is mostly desert. It is home to the largest sand desert in the world. The northwest of the country consists of gravelly plains, and the flat, low-lying eastern section contains the Al-Hasa oasis. The western portion of Saudi Arabia contains a mountain chain that spreads through the entire length of the country.

Throughout the mountains, forested areas contain evergreens. Scrub species and tamarinds grow in the deserts. Camels are the country's most visible animal, as well as a few hedgehogs and sand cats. Hamadryas baboons are located in Asir. These flora and fauna try to survive in an extreme climate. In the deserts from April to October, daytime temperatures rise to 113 degrees F (45 degrees C). Rain falls in the coastal areas regularly, and high humidity is common in the summer months.

In 1932, under the rule of Abd al-Aziz-ibn Saud, the Kingdom of Saudi Arabia was created. During the first half of the 1930s, Ibn Saud ruled over a kingdom that was relatively poor. Riyadh became the center of the kingdom and housed all of its administrative offices. Much of the revenue was brought in through the annual pilgrimages to Mecca, the Muslim holy site. In 1933, the Saudi Arabian government signed a conces-



sion agreement with Standard Oil of California. Sustainable exploration of oil began, and five years later, oil was discovered on the Arabian Peninsula. However, with the outbreak of World War II, the oil did not immediately become a sustainable source of revenue.

During World War II, Saudi Arabia was officially neutral. However, Ibn Saud voiced his support for Britain. As the war continued, the country depended greatly upon British and American subsidies. The United States, with concern over decreasing American oil production, turned to Saudi Arabia, and thus increased its oil explorations in the country.

Saudi Arabia struggled economically after the war. Ibn Saud died in 1953, and his son Saud became the ruler and tried to define Saudi Arabia's policies. The population of Saudi Arabia grew disenchanted with wasteful government spending, low wages, lack of public projects, and missing educational institutions. By the late 1950s into the early 1960s, Saud's brother Faisal was growing stronger in the government. Faisal became the deputy prime minister and eventually foreign minister in 1962. He alone created stronger relations with President John F. Kennedy's administration in the UNITED STATES and began a social reform program to invigorate the economy. After lack of administrative control, Saud was deposed as king and Faisal took over the reign.

Faisal immediately implemented programs that challenged development in the country. He used oil revenues to stimulate the growth in the economy and reaffirmed Islamic principles into the society. He also believed in the introduction of Western technology, and a stronger education system.

In October 1973, after SYRIA and EGYPT attacked Israel, Saudi Arabia and the Organization of Petroleum Exporting Countries (OPEC) boycotted oil shipments to the United States. This form of economic warfare displayed the power of oil and rapidly placed Saudi Arabia on the world stage. The price of a barrel of oil was raised, and the oil revenues aided the state-run programs.

However, before many of the programs had just really begun, Faisal was assassinated. Khalid was the successor to the throne but handed much of the responsibility to Crown Prince Fahd. Saudi Arabia soon embarked on a rapid development plan, which modernized infrastructure, including the transportation system and petroleum facilities. Many foreign workers were employed in the kingdom and a new class of teachers, civil servants, military officers, and businessmen emerged.

By 1990, Saudi Arabia emerged as an influential country in the Middle East. When Iraq invaded Kuwait, Saudi Arabia allowed the international alliance, including 600,000 American soldiers to gather in its country in order to protect it, and to serve as a headquarters for Operation Desert Storm. After the successful Persian Gulf War, around 5,000 American soldiers remained in the country, prompting criticism from Islamic religious leaders over Saudi cooperation with Western nations. In November 1995, a terrorist bomb outside an American military training center in Riyadh killed five Americans. In June 1996, a truck bomb exploded outside a military residence, killing 19 American servicemen. As the Taliban gained control of AFGHANISTAN, Saudi Arabia was one of three countries to formally recognize the fundamentalist government. In February 1998, Osama bin Laden, the leader of al-Qaeda and originally from Saudi Arabia, issued a statement for Muslims to rise up and kill Americans and allies.

On September 11, 2001, when al-Qaeda hijackers (15 of 19 were from Saudi Arabia) attacked the United States, the Saudi government immediately condemned the actions. Over the previous few years, Saudi Arabia has faced criticism from the United States in its role in the war on terrorism but continues to be an ally of the U.S. government. Saudi Arabia has also continued to witness its share of terrorist acts. During 2003, terrorist bombings in May and November killed many and resulted in a major crackdown on fundamentalist groups in the country. As the Middle East faces uncertain times, Saudi Arabia continues to balance interests by continuing to support the United States, while still being a center for the Islamic religion.

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## Sauer, Carl O. (1889–1975)

CARL ORTWIN SAUER was one of the most influential American geographers. Throughout his long and distinguished career, he shaped and fundamentally changed the field of cultural and anthropogeography in the UNITED STATES. Sauer was of German descent, and his ancestors were members of a German pietistic sect affiliated with the Methodists who had settled in Warrenton, MISSOURI, Sauer's place of birth.

After spending a few school years in Germany, he received an A.B. degree in 1908 from Central Wesleyan College in Warrenton. In 1915 Sauer obtained his Ph.D. from the University of Chicago, where he studied with R.D. Salisbury and Ellen Churchill Semple. The latter represented the American version of environmental determinism (also referred to as “environmental-

ism” or “geographic influences”), then the guiding principle of American geography. Although Sauer had enjoyed Semple's lectures at Chicago, he became increasingly dissatisfied with environmental determinism for it focused rigidly, solely, and in a Darwinian manner on the environmental influences on man.

After eight years at the University of Michigan where he became a full professor, Sauer accepted an appointment as professor of geography at the University of California, Berkeley. During his Berkeley years (1923–57), he elaborated the geography often referred to as the Sauer School or the Berkeley School. Although until the 1930s he was sympathetic to regional studies and in his early career he had carried out some studies in this tradition, Sauer expressed growing dissatisfaction with regional geography. Sauer criticized regional studies for their sole focus on the characterization of an area and claimed that they had no value for problem formulation and development of solutions.

To be sure, Sauer neither denied determinism nor did he entirely discard the regional method. But he considered these ways of doing geography to be all too mechanistic and with only limited value for explanation and problem formulation. Subsequently, he came up with his own landscapist view of geography, which regarded time to be the most important dimension of geography.

### CULTURAL GEOGRAPHY

Henceforth, landscape was studied and observed from a historical and genetic perspective. Thus, Sauer's geographical studies were driven by an interest in historical processes and sequences and, moreover, by the aesthetic qualities of landscape. A central role was ascribed to the influences of culture as a shaping force, cultural processes and cultural products as agents of transformation of nature or as elements that give character to area. Sauerian geography of this kind was referred to as landscape morphology, culture history, and also CULTURAL GEOGRAPHY.

In his research, Sauer was predominantly concerned with rural areas, especially in MEXICO and South America. Furthermore, he was interested in geographical aspects of the life of prehistoric and native peoples. He had great respect for both rural and native life and showed no objections to moralist ethical evaluation: Sauer was distinctively critical of the destructive exploitation of land and life and showed a skeptical attitude toward applied geography in the service of profit economy. Part of Sauer's work was regarded as a “silent spring” of the ecological movement.



*Carl O. Sauer was a resolute advocate and protector of the privileged status of geography as an unspecialized discipline.*

In the study of geography, Sauer stressed the importance of geographical inquiry based on observation. He was a fierce opponent of quantitative methods in geography and considered fieldwork and archive work as the main components for the practice and study of geography and was never tired of stressing the importance of independence and self-determination of the researcher. Until his death in 1975, Sauer was a resolute advocate and protector of the privileged status of geography as an unspecialized discipline with interdisciplinary character.

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## scale

SCALE IS A FUNDAMENTAL component of geographic events and processes. Climate change occurs at global scales, while human diseases such as measles occur at essentially local and regional scales. Many geographic processes also occur across multiple scales, and more important, some processes behave differently at various scales. Consequently, an explicit statement of scale is required to understand and compare these geographic processes.

One of the fundamental and frequently encountered constructions of scale is related to maps and the measurement of linear distances from them. Because maps are smaller in physical size than the areas on the earth that are mapped, each map must state the ratio or proportion between measurements on the map and on the Earth. This ratio is referred to as the map scale and is a key element for measuring accurate distances on the map.

Given that the map scale is related to the transformation process between the Earth and the flat map, scale construction is a complex task. Nevertheless, there are four basic formats for depicting the scale of a map. These formats are the representative fraction, the

verbal statement, the graphic or bar scale, and the area scale.

The representative fraction (RF) is commonly stated as a ratio of two numbers separated by a colon. As an example, the representative fraction 1:10,000 means that each unit of measurement (millimeters, centimeters, feet, miles, etc.) on the map corresponds to 10,000 units of measurement (millimeters, centimeters, feet, miles, etc.) on the surface of the Earth. The unit of measurement for the numerator and denominator of the RF ratio must be identical.

Another way to depict map scale is to use a verbal statement of the relationship between linear distances on the map and the surface of the Earth. The statement "one centimeter represents 100 meters" is an example of a verbal statement of scale. The graphic or bar scale uses a subdivided line to mark off systematic distances on the map and their equivalent distances on the surface of the Earth. The map units (kilometers, meters, miles, feet, etc.) are clearly stated near the graphic scale and one end of the bar is usually further subdivided to allow more detailed measurement of distances. The area scale is a graphic depiction that provides information about how much area on the surface of the Earth is represented by a unit area on the map.

In some cases, a map scale may not be evident on the map. Fortunately, the map can still be useful. An estimate of the scale can be determined as follows: select two fixed points for which you know their separation distance in the real world, measure the map distance between these two fixed points, and then divide the map distance by the real world distance for the fixed points to obtain the representative fraction.

The selection of an appropriate map scale must give consideration of the intended purpose of the map, the target audience, and the geographic events being depicted. Geographers use the term *small scale* to mean that the map shows a large section of the Earth and hence only generalized surface features. On the other hand, a *large scale* map shows a limited amount of the Earth's surface and hence depicts a large amount of detail.

Scale also has an effect on the amount of distortion embedded in the map. These distortions come about because it requires greater effort to flatten out larger curved sections of the Earth so that they can fit on a flat map. For maps showing large sections of the Earth (small scale map) the potential for distortion is great. For maps showing a limited section of the earth (large scale map), the distortion is not as great. Thus, measuring distances on continental and global maps should be



treated with caution and the results used only as an approximation.

The gradual expansion of geography into many areas of societal and environmental problem-solving has demanded greater consideration of scale beyond the dominant cartographic traditions. For example, human geographers conceptualize scale based on the human body, household, neighborhood, city, and so on. This reconceptualization is particularly useful for dealing with the dynamic nature of social systems.

On the other hand, biophysical geographers use the notion of operational scale to measure and understand the context in which geographical processes occur. Geographic information scientists use the term *spatial resolution* to represent the granularity of the data being assessed or analyzed. As an example, satellite image A might use a smaller pixel (“picture elements”) size, 10 m x 10 m, in comparison to another satellite image B, 100 m x 100 m, to represent a selected study area. Image A is said to have a greater spatial resolution or finer grain than image B. In recent times, the impact of the internet on integrating the local with the global has radically shifted perceptions about scale in economic and social geography. Newer definitions of scale based on networks of interconnecting objects are now dominating the scale discussions in regional economic geography studies.

The rich definitions and interpretations of scale outlined above are both a challenge and a benefit. The challenge usually occurs when it comes to understanding scale concepts across subdisciplines. This causes a mismatch in syntax and semantics with negative consequence for scale integration and understanding of processes. However, context-dependent constructions of scale provide more flexibility and critical awareness of our understanding and representation of reality.

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## Sea of Azov

THE SEA OF AZOV is an arm of the BLACK SEA, extending from the mouth of the River Don to the Kerch Strait. It covers 14,520 square mi (37,230 square km) and is 226 mi (365 km) east to west, and 110 mi (175 km) north to south. RUSSIA borders the sea to the east, with UKRAINE to the north and the Crimean Peninsula to the west and south. The sea has an average depth of only 26 ft (8 m), making it the shallowest sea in the world. The northeast portion narrows to form the Gulf of Taganrog (also known as the Gulf of Azov), which is an extension of the Don estuary. Here, the average depth is less than 3.3 ft (1 m), requiring constant dredging of channels for deep-sea vessels. The other major river that flows into the Azov is the Kuban, which runs from the North Caucasus mountains to the east. The Don and Kuban rivers bring in large amounts of fresh water, resulting in the sea's low salinity levels. In winter, much of the sea is covered in ice.

Because of its mixture of fresh and saline waters, the Sea of Azov has the second-largest fishing industry in Russia, though this has suffered in recent decades from over-fishing and pollution. The Azov is also important as a transportation corridor for coal and iron ore extracted from the nearby Donets basin, in eastern Ukraine, and for river traffic from Russia's vast interior, traveling via the VOLGA-Don Canal. The Manych Canal also links directly to the CASPIAN SEA and its reserves of oil and natural gas. Salt is extracted in large quantities from the area known as the Syvash (or “putrid”) Sea, a backwater along the Crimean Peninsula (the northwest coast of the Sea of Azov) that derives its name from the area's unhealthy odor of decaying vegetation. The Arabat Peninsula separates the Syvash from the main Azov waters: a narrow strip of mud and sand, varying from 3,000 ft to 2.5 miles (1 to 4 km) in width, stretching for 70 mi (113 km). The Genichesk Strait connects the two bodies of water but is occasionally silted over.

The settlements surrounding the Sea of Azov were always important centers of trade between the Mediterranean world and the Eurasian interior. The Greek city of Tanaïs, established in the 7th century B.C.E., went through several incarnations—including a Genoese colony in the 13th century (Tana)—before becoming the Ottoman outpost of Azov. Russian desires to establish a warm-water fleet led to several campaigns against the Turks, but the city was not definitively taken until 1774. Today, several other major port cities surround the Sea of Azov, including Rostov and



Taganrog (Tahanrih) at the mouth of the Don, Berdyansk and Mariupol on the northern shore, and Kerch at the narrow point between the Sea of Azov and the Black Sea.

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## Sea Peoples

SEA PEOPLES ARE one of the populations of the ancient world who vigorously shaped the cultural landscapes in the eastern Mediterranean and adjacent lands. Sea Peoples were active from EGYPT to GREECE and as far as Sardinia and Corsica, and they reached the apex of their activity around 1200 B.C.E. They were a people or clans of seafarers who invaded eastern Anatolia, SYRIA, PALESTINE, CYPRUS, and Egypt throughout the 2nd millennium B.C.E. They are said to have been a loose naval confederation from the eastern Mediterranean. The exact ethnic origin, culture, and language are still unknown, and there is a variety of theories regarding their origins, which constantly evokes our imagination. The term *Sea Peoples* was introduced by the French Egyptologist Gaston Maspero in 1881. Despite their name, it should be noted that the Sea Peoples were adept warriors who were capable of using land and ocean efficiently, and their main military campaigns were conducted over land.

One of the well-accepted theories states that the Sea Peoples were a number of primarily Indo-European groups that were displaced during the late 13th century B.C.E. because northern invaders impacted upon their homelands in the AEGEAN SEA region.

Today, Egyptian temple reliefs are valuable resources to gain important information on the Sea Peoples regarding their appearance, attire, weapons, and ships, as are the battle scenes carved into the stone wall of temples particularly in the vicinity of Thebes. These visual records indicate that there was more than one ethnic or cultural type of Sea Peoples. Additionally, the Sea Peoples are portrayed in Egyptian texts of the 13th and 12th centuries B.C.E. with inscriptions, and their

existence is observed in carvings on other Egyptian monuments. The Sea Peoples' relationship with Egypt was highly charged with violence and territorial ambition, which culminated in two major wars that presumably had disastrous effects on the Egyptian dynasties. Before the emergence of the Sea Peoples in the Aegean, particularly during the two millennia prior to 1200 B.C.E., the eastern Mediterranean region enjoyed political stability and economic prosperity.

Extensive trading routes via land and sea were developed, but these routes were taken over by the Sea Peoples. Thus, the advent of the Sea Peoples in the Mediterranean region changed cultural and political landscapes substantially and permanently in many ways. Starting near Ugarit (today's Latakia, SYRIA) and continuing south, the Sea Peoples eventually ran into Egyptian forces. Before attacking Egypt, they destroyed Troy, the Hittite Kingdom, defeated Syro-Palestine, and even attacked the Nile Delta region, although this attempt was futile.

Overwhelming Crete and Cyprus, the Sea Peoples ultimately attacked the late 19th and early 20th dynasties of the Egyptian Empire from northward during the reign of Ramses III. Although Egypt fortified with the pharaoh's armies was not defeated, the Sea Peoples were allowed to settle in the peripheral territories of Egypt in Canaan, today's ISRAEL and PALESTINE. It is generally accepted that these new settlers were the Philistines of the Bible. Approximately a century after the settlement of the Sea Peoples, the Egyptian Empire began to decline.

This decline marked another series of wars over the control of Canaan between the sea-faring Philistines and the hill tribes of Hebrews. The majority of the sources that we have for the following 3,000 years about the Philistines are from the Hebrew side, which further obscured the characteristics and origins of the Sea Peoples. The Philistines, descendants of the Sea Peoples, formed a politically independent entity, and as architectural remains and early styles of Philistine pottery evince, their tradition was presumably generated from those of the ancient Mycenaean culture. Despite their advanced technological skills, the Philistines' prominence in history of the two millennia ended over the two centuries.

One crucial problem was the disruption of trade network, which cut off the supply of tin to combine with copper to make bronze. The development of iron technology in response to the shortage of bronze for tools and weapons might have been inevitable. The Philistines long held a monopoly on iron smithing, a

skill they probably acquired during their conquests in Anatolia.

Throughout ancient history, the Sea Peoples and Philistines actively engaged in forming cultural landscapes in the Mediterranean and beyond, which involved late Egyptian records and early biblical narratives. As the Sea Peoples were known to attack national capitals and administration, they were almost always considered to be a negative and destructive force for the region. In contrast to their destructive activities through military campaigns, the creation of the Philistine and Phoenician civilizations, which eventually grew to be prominent entities in the eastern Mediterranean region, are also attributed to these peoples. Throughout history, the Sea Peoples left a long-lasting imprint in Mediterranean geography.

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## seamounts

SEAMOUNTS ARE MOUNTAINS more than 3,281 ft (1,000 m) high that rise from the seafloor and do not break the water's surface. Some seamounts occur thousands of meters beneath the ocean surface, while others are only dozens of feet from the surface. Seamounts vary in form as well—seamounts whose tops have been truncated by wave action resemble volcanic cones. Some seamounts are still growing; the Tabango Seamount near the PHILIPPINE islands of Leyte and Cebu grew a total of 32.8 ft (10 m) from 1992 to 1997.

Seamounts are found in every latitude and ocean basin, and it is estimated that there are tens of thousands of such undersea mountains under the world's oceans. Together with deep ocean basins and seafloor trenches, the presence of seamounts suggests a highly complex ocean topography, much of which has not yet

been explored. The first to be termed a seamount was the Davidson Seamount off the CALIFORNIA coast in 1933, but it was only in recent decades that there has been scientific interest in their natural and physical characteristics.

The origins of many seamounts are still being debated by scientists, as some isolated seamounts and seamount chains formed near midocean ridges as hot spot volcanoes on new oceanic crust, while others were formed through their eruption over much older oceanic crust; the origins of the latter are more uncertain. Seamounts are more commonly found in chains or groups, and these tend to be volcanic in origin. Isolated seamounts and those not formed from volcanic activity but by uplift tend to be less common; examples include the Great Meteor Seamount in the northeast ATLANTIC OCEAN. Seamounts with volcanic origins include the Loihi and the Emperor Seamounts, both of which are part of the Hawaiian Ridge-Emperor Seamounts chain that comprises more than 80 large volcanoes and extends some 3,728 mi (6,000 km) from the Big Island of Hawaii to the Aleutian Trench off ALASKA. Some of these seamounts, like the 9,842-ft- (3,000-m-) high Loihi, are active volcanoes. The individual seamounts of the Emperor Seamounts chain were named by Robert Dietz in 1954 for the emperors of JAPAN, notably Kimmei, Nintoku, Suiko and Yuryaku, and the chain is thought to be formed by the movement of the North Pacific Plate over the stationary Hawaiian hot spot.

Apart from the interest in their geologic origins, seamounts also make excellent laboratories for understanding patterns of marine biogeography and diversity. Seamounts are areas of high biological production as their physical projection toward the sea surface and toward zones of sunlight penetration provides hospitable conditions for marine habitats, including those supporting commercially viable fish and coral. As a result, seamounts are "oases" in the open ocean teeming with rich marine life. In addition, seamount habitats are possible centers of speciation and display high degree of endemism, supporting plants and animals that do not occur anywhere else or are genetically removed from their nearest neighboring population. Seamounts also appear to be important stopping points for large migratory animals such as whales, which use these features as navigational aids.

Seamounts are large landform features and can significantly influence water masses and water circulation patterns of the surrounding ocean, acting as obstacles around which water currents may be diverted. As a re-

sult, seamounts may deflect deep ocean currents and bring about the upwelling of nutrient-rich waters from the deep sea into the near-surface zones where sufficient light can penetrate to allow for photosynthesis, thereby enhancing biological production and biodiversity in the areas around them. Much of this rich reservoir of biodiversity on seamounts remains to be studied.

Together with the economic dependence of people on fish catch in seamount environments, the unique ECOSYSTEMS and vulnerable marine populations found on seamounts have led to calls for the careful management of such environments, especially since less than half (47 percent) of seamounts fall inside exclusive economic zones (EEZs) as Marine Protected Areas (for example, the Tasmanian Seamounts Marine Reserve in Tasmania, AUSTRALIA). The rest occur in international waters and are therefore vulnerable to international exploitation.

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## seasons

A GREAT DEAL OF the variation that exists in the Earth's physical phenomena is caused by the revolution and the ROTATION of the earth. The rotation of the Earth on its axis every 24 hours and the revolution of the earth around the sun every 365 days regulate the amount of electromagnetic energy received by the Earth's surface. Another factor which influences the amount of energy upon the earth's surface is the tilt of the earth's axis. The tilt of the Earth's axis in conjunction with the earth's revolution about the sun results in seasonal and diurnal variations. These variations affect

the circle of illumination and duration of daylight and darkness at different points on the globe.

These relationships result in the seasons: summer, winter, spring, and fall. The seasons reflect a change in temperature throughout the year: a full rotation around the sun. Temperatures reach their extremes in summer, the hottest months, and winter, the coldest months. Fall and spring temperatures fall somewhere in between these extremes of hot and cold temperatures. The seasons repeat themselves every year fairly regularly.

The seasons are due to the movement of the earth around the sun and the tilt of the Earth's axis. The Earth's orbit around the sun is an ellipse, so some times during the year the Earth is closer to the sun than at other times. However, the change in distance from the sun during the Earth's rotation is relatively small and does not account for seasonal changes in temperature.

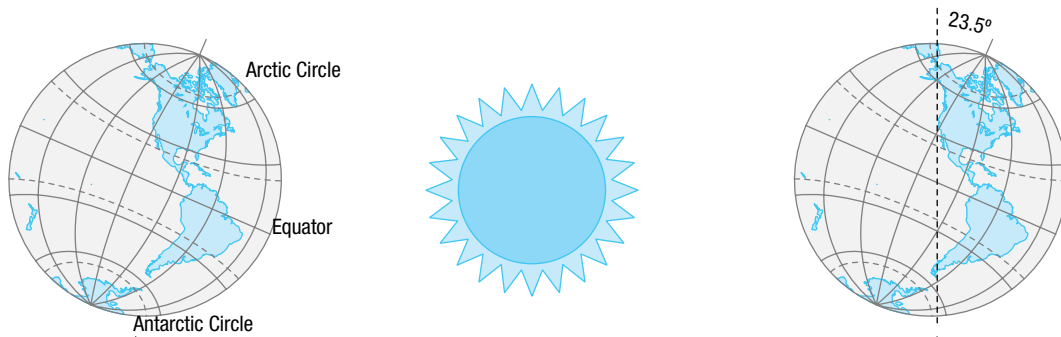
The tilt of the Earth's axis, 23.5 degrees with respect to the plane of the perpendicular of the Earth's orbit, is the primary cause of the seasons. As the earth circles the sun, the orientation of the axis remains the same. This means that as the Earth orbits the sun the Northern Hemisphere is at various times of the year oriented more toward the sun, and this is similarly true for the Southern Hemisphere. Summer occurs in the Northern Hemisphere when the Earth's Northern Hemisphere is oriented toward the sun. The sun is higher in the sky and is above the horizon longer, and the rays of the sun strike the ground more directly. This causes longer daylight hours and increased temperatures. Conversely, winter in the Northern Hemisphere occurs when the Earth's Northern Hemisphere is oriented away from the sun. The sun is lower in the sky and is above the horizon for a shorter period, and the rays of the sun strike more obliquely. This results in shorter days and cooler temperatures.

The duration of daylight and darkness vary seasonally everywhere except at the equator, which is always cut exactly in half by the circle of illumination. The inclination of the Earth's axis affects the angle of the sun above the horizon. The angle of incoming solar radiation is dependent upon the declination of the sun—how far north or south of the equator the sun's rays strike during a given time of the year.

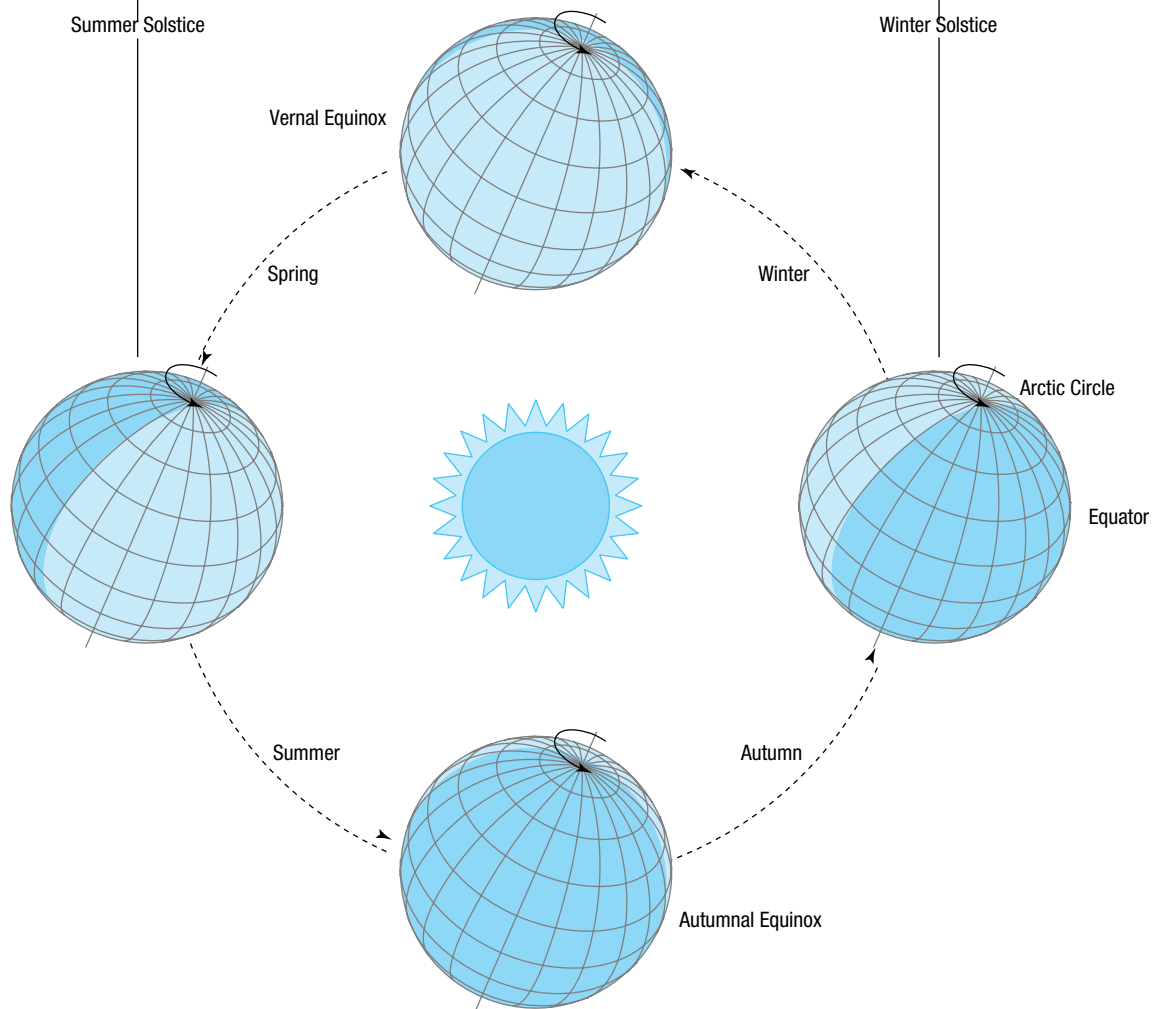
The most direct and intense solar radiation occurs between the TROPIC OF CAPRICORN (23.5 degrees south) and the TROPIC OF CANCER (23.5 degrees north). The winter solstice is the day when the noon sun is directly overhead at the Tropic of Capricorn. In the Northern Hemisphere, this is the shortest day of the year. The

The earth's seasonal changes are the result of 1) the angle of the earth's axis, and 2) the earth's yearly orbit around the sun.

1)



2)





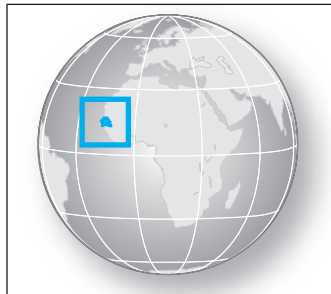
summer solstice occurs when the noon sun is directly overhead at the Tropic of Cancer. In the Northern Hemisphere, this is the longest day of the year. Midway between the solstices—approximately March 21 and September 21—the noon sun is directly above the equator. At these two times of the year, the periods of daylight and darkness are of equal duration. The vernal equinox occurs in March; the autumnal equinox occurs in September. The exact dates vary according to the astronomical relationships between the Earth and sun.

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## Senegal

**Map Page** 1113 **Area** 75,749 square mi (196,190 square km) **Population** 10,580,307 **Capital** Dakar **Highest Point** 581 ft (177 m) **Lowest Point** 0 m **GDP per capita** \$469 **Primary Natural Resources** fish, phosphates, iron ore, natural gas.



SENEGAL IS A FLAT, low-lying arid country located on the westernmost cape of Africa. Bounded by the ATLANTIC OCEAN, MAURITANIA, MALI, GUINEA, and GUINEA-BISSAU, Senegal has well-defined dry and rainy seasons. The wet season lasts from June to October, with occasional tornadoes usually followed by thunder, lightning, and wind squalls. Annual rainfall ranges from 13 in (34 cm) in the extreme north to 61 in (155 cm) in the southwest. During the dry season, usually from December to February, southwesterly winds called harmattan, bring in dry and dusty air from the SAHARA DESERT; temperatures are cool at night and scorchingly hot during the day.

Senegal is mostly covered with rolling plains and is usually divided into five regions: the coastal region, the Senegal River Valley, the Ferlo in the north, the Eastern Region, and the Cassamance. The northern region is covered by savannah woodlands where elephant grass is the most characteristic vegetation, interspersed by mahogany, rosewood, and baobab, and fruit cultivation such as mango, guava, orange, tangerine, grapefruit, coconut, papaya and tamarind. The Cassamance, which is separated from the rest of the country by the Gambia River, is markedly different from other areas. It receives abundant rainfall, which supports rice growing, luxuriant forest, and oil palm plantation.

There are a network of seven national parks that support the conservation of more than 300 species of birds, 70 species of animals, and at least 60 species of fish. The Niokolo-Koba National Park is a major tourist attraction that allows tourists to watch a sample of African wildlife such as buffalo, gazelles, black antelope, bushbuck, roan antelope, waterbuck, hippopotamuses, lions, apes, crocodiles, and warthogs.

Most of the Senegalese population reside in coastal urban areas, with over 2.5 millions living in Dakar the primate capital city, and Saint-Louis, the third-largest city and second-largest port. Dakar, the westernmost city of Africa is 75 ft (23m) above sea level. The city enjoys a salubrious temperate local climate with moderate temperatures and an annual rainfall of 23 in (58 cm).

As a capital city, it is the center of administration, cosmopolitan culture, trade, and industry. About 75 percent of the country's trade passes through the city, which is the main hub of all modes of transportation and the premier tourist destination in the country. The only university in the country, Universite de Cheik Anta Diop, is located in the northwest suburb of Dakar. Approximately 95 percent of Senegal's population are black Africans, mostly Muslim representing over a dozen ethnic groups, each with its own customs and language. The three largest groups are Wolof (36 percent), Fulani (17 percent), and Serer (17 percent). The French language and way of life are encouraged to minimize ethnic differences.

Politically, Senegal is a republic that is dominated by one ruling party (the Socialist Party) since independence in 1960. In 2000, however, through a coalition with other opposition parties, the Senegalese Democratic Party was able to defeat the Socialist Party and install their leader Abdoulaye Wade as president. The economy is based on agriculture, which for over a century was dependent on groundnut as a cash crop. Di-

versification into poultry production, cotton, and rice-growing has been successful compared to the dismal performance of the subsistence sector, where the cultivation of crops as corn, millet, and sorghum either stagnated or declined, making it necessary for Senegal to import more than a third of its food requirements. Fishing for both local consumption and export is a major source of revenue; in 2000 the revenue from fish exports was \$239 million compared to \$79 million from groundnuts. Other exports include phosphate, iron ore, gold and titanium. Tourism is a growing industry that contributes 10 percent of national income.

Although as a destination Senegal has much to offer in terms of natural attraction (beaches, climate, wildlife, landscapes), history, and culture, tourists' experience is likely to be affected by increasing encounters with petty crimes and street hustlers. As with many other developing countries, Senegal is unfortunately burdened with foreign debt. In 2001, it owed international bodies such as the World Bank, International Monetary Fund, and commercial banks around \$3.5 billion, which is nearly the value of its gross domestic product.

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## Seoul

AS THE MODERN capital of South KOREA, Seoul has a varied and vibrant character that reflects an ancient heritage as well as rebuilding and urban development in the post-World War II period. It ranks as the fifth-largest city in the world and has a population of some 10.8 million. It is situated in the Han River basin near the coast in the northwest province of Kyonggi-do and lies some 38 mi (60 km) south of the demilitarized zone (DMZ), which has separated North and South Korea since the end of the Korean War in 1953.

Seoul enjoys a temperate climate with an average temperature ranging from 7.3 degrees F (-13.7 degrees

C) in January to 97 degrees F (36.1 degrees C) in July; there is an annual precipitation of 47.2 in (121 cm), which falls mainly during the late summer monsoon months.

### CITY ORIGINS

The origins of Seoul date back to 4000 B.C.E. when Neolithic (New Stone Age) peoples settled in the Han basin. However, the first written records of Korea are in Chinese, reflecting the presence of Chinese overlords in the Korean peninsula about 2,000 years ago. At this time a town called Wiryesong was established on the south bank of the Han as the capital of the Baekje kingdom, which persisted between the 3rd and 7th centuries C.E. During this time, the Korean peninsula was ruled from three centers; thus it is known as the Three Kingdoms Period. In the Seoul area, the Baekje kingdom was superseded by the Silla kingdom; Wiryesong lost its power and was renamed Hansong. The next kingdom, the Goryeo, from which Korea derives its name, was established in 918 by a soldier from the northern kingdom of Goguryeo, and Hansong became Yangju, one of three secondary capitals. Despite invading Mongol influence in the 13th century, the Goryeo kingdom persisted.

By 1392, the Chosun dynasty was founded by Yi Songgye, a Korean general who fought the Ming Chinese and deposed the ruling Korean king. He established Yangju as the capital and renamed it Hanyang. It eventually became known as Seoul, which is derived from the Korean word for "capital" and was the center of learning, culture, and government. Population was in the order of 100,000 by the early 15th century and Confucianism rather than Buddhism had become the dominant religion. Although this dynasty persisted until 1910, Seoul and Korea experienced many influences and invasions. The Japanese invasion of 1592, for example, caused much devastation in the city and further upheaval occurred as the Koreans and Chinese collaborated to rout the Japanese. Another Japanese invasion occurred in 1636, when the Manchus took control and Seoul was again badly damaged. By 1700, the Manchus, with Korean collaboration, had expanded into China.

### HERMIT KINGDOM

For the next 150 years, Korea enjoyed some stability but became known as the hermit kingdom because of its insular and isolationist attitudes. By the mid-1800s, the advent of Christianity altered relationships between the rich and the poor as the latter grew more vocifer-

ous and thus new class relationships emerged. Another influence of the time was a new wave of Japanese invaders in 1894, though Korea was not annexed as a colony until 1910. In 1911, Seoul was renamed Kyongsong. The Japanese actively developed Korea by building a railway network, including the railway station in Seoul. Trade, industry, and commerce were encouraged throughout the country, and Seoul became a hub of such activities as well as a military center. Modern Seoul was born.

At the end of World War II, the Korean peninsula, rather than being united, was divided; the UNITED STATES controlled the region south of the 38th parallel, while the Soviet Union controlled the region to the north. The Cold War accentuated this split and culminated in the Korean War between 1950 and 1953. It began with a shift south of North Korean troops, who rapidly captured Seoul and a swift counterattack by United Nations forces under U.S. leadership that restored the beleaguered city to South Korean control.

The Chinese assisted the North Koreans, and the country and Seoul experienced considerable damage from armaments. Overall, the city was captured twice and retaken twice. The truce of 1948 led to a rebuilding program and the reinstatement of the name *Seoul*. Between 1950 and 2000, the city was transformed as South Korea has industrialized and become a major component of the so-called tiger economies of East Asia and the Pacific Rim.

Development has not stopped with restoration after war. High-rise apartment blocks attest to the city's high population density as do satellite towns in Seoul's periphery. Its many hotels attest to affluence, the importance of tourism and its role as the commercial center of Korea. It has industrial, commercial, and retail areas juxtaposed with restored buildings, such as Kyongbok-kung palace, originally constructed in the 14th century. It is a center of culture and learning with no less than 33 universities and many museums, including one dedicated to war that contains poignant reminders of the two Koreas' and Seoul's war-ravaged past.

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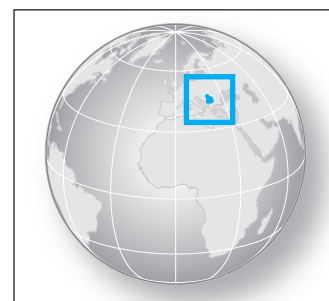
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*Seoul lies some 38 mi (60 km) south of the zone that has separated North and South Korea since the Korean War in 1953.*

## Serbia and Montenegro

**Map Page** 1133 **Area** 39,518 square mi (102,350 square km) **Population** 10,655,774 **Capital** Belgrade **Highest Point** Deravica 8,765 ft (2,656 m) **Lowest Point** 0 m **GDP per capita** \$2,370 **Primary Natural Resources** oil, gas, coal, antimony, copper.



SERBIA AND MONTENEGRO is a country in the central Balkan Peninsula, the rump of the former federation of south Slavic peoples known as Yugoslavia. Until 2003, it continued to use the name *Yugoslavia* but has since been known as the State Union of Serbia and Montenegro. The dual state consists of Serbia, the largest of the former Yugoslavian states, and Montenegro, the smallest. The two states have a similar history and share the same religion and language, unlike some of the other South Slavs who are Catholic. But they associate together for more economically driven reasons as well, Montenegro for the support of a larger economy and population, and Serbia for the access to the sea provided by Montenegro's 123 mi (199 km) of coastline along the ADRIATIC SEA.

And yet there is considerable movement to dissolve even this last link of the old Yugoslavia, as Montene-



grins attempt to revitalize their economy and strengthen their ties with Western Europe at a faster rate than their more troubled partner, Serbia. The loose federation formed in February 2003 was meant to stall this action, with an agreement to hold a referendum in three years, but recent activity in the Montenegrin parliament may signal a more imminent dissolution. The two states today are linked only in matters of foreign affairs and defense.

Within Serbia itself there are also political and ethnic divisions that continue to trouble the economy and prosperity of the region. Two autonomous provinces occupy about one-third of Serbian territory: Vojvodina and Kosovo. The Vojvodina in the far north, with its capital of Novi Sad, is a wealthy province with the country's richest river valley agricultural land, dominated by the confluence of the DANUBE, Drava, and Sava rivers. The population is predominantly Serb but has a significant minority population, primarily Hungarians (nearly 300,000), followed by Slovaks and Croats (each about 50,000), and smaller numbers of Romanians and Roma (Gypsies).

Ethnic tensions here have largely remained at a minimum, in contrast to Serbia's second autonomous province, Kosovo, in the far south. Officially known as Kosovo and Metohija, with its capital of Pristina, the region is the only remaining area of unresolved conflict in the Balkans. The population is predominantly Albanian, but their claims for independence have so far been suppressed by NORTH ATLANTIC TREATY ORGANIZATION, EUROPEAN UNION, and United Nations (UN) actions; the UN Interim Administration Mission in Kosovo (UNMIK) retains control of local government until a settlement with Serbia can be resolved. Altogether, 33.7 percent of the Serbian-Montenegrin population belongs to minority communities.

Serbia and Montenegro is bordered by other former members of the Yugoslav federation: BOSNIA AND HERZEGOVINA, CROATIA, and the Former Yugoslav Republic of Macedonia (MACEDONIA). HUNGARY lies to the north, while ROMANIA and BULGARIA are to the east. ALBANIA is across the border with Kosovo to the south-west. Aside from the fertile river valleys of Vojvodina in the north, most of Serbia and Montenegro is mountainous (Montenegro, or Crna Gora, means "black mountain"). Limestone ranges and basins run mostly north to south in the east, with higher mountains in the far south.

The coastline of Montenegro is rugged, with sheer cliffs and a warmer, more Mediterranean climate than the continental climate of the interior. The mountains

of Montenegro are the southern extension of the Dinaric Alps—their ruggedness is the primary reason for the existence of Montenegro's separate history as a haven from centuries of Turkish occupation and as an independent principality dating from 1878. Aside from the major rivers of the north, Serbia is also crossed by the Morava River, which drains most of the south and west of the country and provides the country's major north-south transport corridor. Montenegro's only major river is the Morava, which flows past the capital, Podgorica, and into the large lake, Skadar (Shkodër) that it shares with Albania.

This mountainous country is prone to earthquakes and mudslides and suffers from communist-era industrial pollution, notably water pollution in the Adriatic and air pollution in the Serbian (and federative) capital, Belgrade, a city of about 2 million people. The economy is functioning at only about half its strength because of government mismanagement, international sanctions and warfare during the 1990s. Montenegro severed its economic links from Belgrade and still maintains its own central bank and even uses the euro as official currency, not the dinar. Primary industries include production of chemicals, farm equipment, paper, glass, textiles, agricultural products such as sugar, wheat, and tobacco, and some minerals such as zinc, lead, and copper.

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## service industries

SERVICES HAVE become a driving force in the global economy and the rise of the "new economy" amplifies this trend. However, for a long time, services were viewed as nonproductive activities. This situation was also justified in terms of services as invisible and intangible inputs to other material products that were largely supplied on an individual basis rather than in an integrated, horizontal fashion. Services were largely produced and consumed simultaneously and most



were not regarded as being able to be traded, whether within or between national economies. Recent improvements in technology, coupled with reductions in trade barriers, have increased the opportunities for market services internationally. Also, services have influenced the cost structure and relative competitiveness of firms, industries, and regions.

Defining *services* is not an easy task. With the expansion in corporate outsourcing activities alongside the perceived need for firms to become more market- and service-oriented, it has become increasingly difficult to identify service companies (employees provide many internal and external services, including those in manufacturing firms). It has generally been accepted that services differ from manufacturing products along the dimensions of intangibility, heterogeneity, inseparability, and perishability. Furthermore, the intrinsic nature of any service is to interact with and support the reproduction and production needs of other economic activities. Services are not just economic. Services are heterogeneous and they are profoundly rooted in social and cultural transactions. Basically, services industries include retail and distribution; financial services, including banking and insurance; hotels and tourism; leisure, recreation, and entertainment; and professional and business services, including accounting, marketing, and law. Several categories of services exist; however, one should distinguish between hard services and soft services.

Service industries are central, not peripheral activities. They are now considered the largest economic element of developed nations. In developed countries services can represent as much as 80 percent or more of the gross domestic product (GDP). In developing economies, services represent on the average approximately 50 percent of the GDP. Nonetheless, total world services trade is a fraction of world goods trade, showing the need to reduce barriers.

### GEOGRAPHY OF SERVICES

The geography of services is no longer of local or national significance: it now embraces an international state. Service industries have been enabled and become participants in world trade. In 1986, the Uruguay Round and the World Trade Organization (WTO) created a significant agreement—the General Agreement on Trade in Services (GATS)—because it began to reduce previous national restrictions placed on the market of international services and foreign direct investment. The agreement was expected to increase international trade and the growth of the global econ-

omy. Statistics show that in the UNITED STATES, the service sector now constitutes 77 percent of the workforce.

Although this is not a new role, during the 1980s service industries became a much more active force in the process of social and economic change. For exporters, both in developed and (in growing numbers) in developing countries, there is an increase in income and jobs. For importers, again in both developed and developing countries, access to state-of-the-art services in a host of different sectors provides the essential infrastructure, without which economies could not achieve full potential. Also, trade in services requires the presence of a particular infrastructure (such as banking, auditing, or corporate legal advice).

### INCREASED CONSUMPTION

New and diversified services have generated increased consumption, ranging from tourism and leisure to sophisticated innovations in ways of making financial capital available. Service industries are strongly concentrated in major urban economic areas (and districts) and have influenced the emergence of special locales, such as LONDON; spaces of consumption such as shopping malls; office working spaces; and urban service clusters. Main cities normally absorb the major part of services, mainly advanced ones, so the surrounding areas must buy many of these activities in the center. Services can be internally or externally provided. However, the spatial interrelations between supply (workers, establishments) and demand differ according to the type and nature of the services. There are also some limits to the concentration of the service industries (congestion costs, environmental issues, and other limits derived from the agglomeration economies).

Service industries in general tend to be less international than manufacturing, and the internalization process of service firms differs significantly. Service firms have been slower to expand internationally than their counterparts because many firms faced the inseparability and the perishability of most services. Additionally, the high fixed-cost structure of many service industries and the problems of unfamiliarity and service intangibility make it difficult for all but the largest service firms to successfully create enough local business to establish and support an overseas operation. They also face problems arising from heterogeneity (that is, variability in service output). This implies that firms will have trouble maintaining a consistent worldwide brand image, which will lead to difficulties in controlling international operations. It has been further suggested that the market for services is not homoge-

neous between nations as government conditions and restrictions are also thought to have a larger impact on services than on manufacturing firms.

These factors require that service providers need to be physically proximate to the service consumer and that the output of service firms cannot be stored. As a result, this restricts the ability of the service firm to venture overseas to export and therefore requires the establishment of local national subsidiaries. Many researchers have revealed that most service firms are not operating in a purely multilocal form but that many have started to integrate and coordinate their international subsidiaries.

Over the last two decades, global services rose worldwide at an impressive rate. Service employment as a proportion of total employment rose steadily during the late 1980s and early 1990s, most notably in developed countries such as the United States, CANADA, the UNITED KINGDOM, and FRANCE. The rate of increase of new business has currently eased but still remains strong. From the mid-1990s onward, the increase in the share of service employment in total employment began slowing down. Growth in employment is currently lagging behind the upturn in economic growth, but one expects recruitment to accelerate in the next few years as the recovery in the global economy for services keeps growing.

Ongoing changes in the economy are now influenced by service industries. The evolving spatial and structural attributes of service industries and their impact on individuals, firms, regions and institutions (performances, modes of organization, internationalization's effects, and intrametropolitan location dynamics) provoke the emergence of new, complex, and interesting issues in society.

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## severe weather

IN THE UNITED STATES, severe weather is defined as a tornado, winds greater than 58 mi per hour (93 km per hour) or hail greater than .75 in (1.9 cm) in diameter. Other countries sometimes include heavy precipitation or a large amount of lightning in their definitions of severe weather. Severe weather is usually considered to come from thunderstorms but other storms, such as blizzards and downslope windstorms, with sufficiently high winds could qualify. The U.S. definition has grouped events that tend to occur under similar meteorological conditions. These conditions are not necessarily the same ones that favor heavy precipitation or large amounts of lightning. The following discussion emphasizes the three elements in the U.S. definition as they are produced by thunderstorms. These features are more likely to come from supercell thunderstorms and are favored by conditions that give rise to these storms. Some comments will also be made about heavy precipitation.

A tornado is a rapidly rotating column of air that extends downward from a cumulonimbus cloud to the ground. Winds in the tornado move upward as well as around the center. Within the cumulonimbus cloud, it predominately forms in and near the updraft. It can range from tens to hundreds of meters wide and is often visible as a funnel-shaped cloud. It is too small for the Coriolis force to influence its motion and therefore may rotate in either direction. Tornadoes are more common over relatively flat terrain where strong horizontal temperature gradients occur. Although they are generally favored by environments with strong vertical wind shear, tornadoes that do not come from supercell storms may occur when the environment contains relatively little wind shear.

Tornadoes occur in several distinct areas of the world but are most common in FLORIDA, the central UNITED STATES, and south-central CANADA. In these places, cyclonic (counterclockwise in Northern Hemisphere) rotation is typical. Although most tornadoes

are relatively weak with winds less than 112 mi per hour (180 km per hour), winds in very strong tornadoes may be greater than 300 mi per hour (482 km per hour). The average lifetime is about five minutes, but in some cases, they have lasted several hours. Tornadoes are more frequently associated with supercell thunderstorms but have been known to occur with ordinary cell thunderstorms also.

Before the tornado appears, there will be a lowering of the cloud base in the part of the cloud from which the tornado will appear. This formation is called a wall cloud. A funnel cloud with rapidly rotating winds may be seen to extend down from the wall cloud. When the funnel cloud reaches the Earth's surface, it is considered a tornado. In some cases, the tornado will reach the Earth's surface before there is a visible funnel cloud. The tornado may contain smaller zones of rotation within it called suction vortices. As it reaches the end of its life, the vortex of many tornadoes shrinks in size. The tornado is considered to be in the rope stage but can still be dangerous.

The primary hazard of tornadoes is from their intense winds and the debris driven by these winds. The intensity of tornadoes is measured with the Fujita scale. The scale ranges from F0 to F5. F0 tornadoes have winds less than 72 mi per hour (115 km per hour) and F5 tornadoes have winds greater than 260 mi per hour (418 km per hour). F0 tornadoes cause relatively minor property damage and very few deaths. F5 tornados can damage even steel-reinforced concrete buildings. Although only 2 percent of tornadoes are F4 or F5, they account for about 70 percent of all tornado fatalities. The tornado is a small storm and winds vary greatly within it. Therefore, tornado damage is erratic; one structure may receive substantial damage while another one close by receives little. Tornado warnings have previously relied heavily on human spotters. Today's Doppler radars can often indicate the presence of a tornado before spotters see it.

Thunderstorm winds that do not involve rotation about a vertical axis are called straight-line winds. The strongest straight-line winds are in excess of 134 mi per hour (215 km per hour). These winds originate in the downdraft of the thunderstorm. They include both the microburst (less than 1.8 mi or 4 km in diameter) and macroburst (greater than 1.8 mi or 4 km diameter) types of downburst. Clusters of thunderstorm cells with strong straight line winds are known as derechos.

These winds are formed by an unusually strong downdraft. The downdraft of the thunderstorm forms as precipitation drags on the upward-moving air. Some

precipitation may mix with the unsaturated air outside the cloud and evaporate. The latent heat used for this process cools the air and can cause it to become denser than the surrounding air and to sink at an accelerating rate. Once the downdraft leaves the cloud base, additional evaporating may cool it further, resulting in even denser air. The downdraft hits the surface and spreads out horizontally. The leading edge of this downdraft air is called the gust front or the outflow boundary. The gust front may or may not be visible to the observer from a distance.

At one time, when less was known about straight-line winds and severe thunderstorm structure, the damage caused by these winds was often attributed to tornadoes. Indeed these winds cause many of the same types of property damage as tornadoes. Winds of the microburst variety can be extremely hazardous to aviation. As a microburst hits the Earth's surface, winds spread out in all directions. If an aircraft flies through the microburst it will go quickly from a region containing headwinds to one containing tailwinds. This can cause an aircraft near the ground for takeoff or landing to crash. Since the microburst often cannot be seen, the pilots may not know they have encountered it. Microbursts can often be detected by Doppler radar. In addition, many airports have now installed supplementary wind-measuring equipment to help detect microbursts and warn pilots.

## HAILSTORMS

Hail is frozen precipitation consisting of concentric layers of ice. Hail forms as the precipitation element interacts with the thunderstorm updraft. It may start to fall and then be carried upward by the updraft. As it travels through the storm it gets coated with liquid water that subsequently freezes on the developing hailstone. This process continues until the hailstone is carried out of the updraft or until it becomes large enough to fall through the updraft. Thus, hail tends to fall out of the part of the thunderstorm between the updraft and the downdraft. Hailstones have been known to grow as large as 5.5 in (14 cm) in diameter. Hail often has layers, some of which are clear ice and some of which are a milky white. If the air is very cold, water freezes quickly on the hailstone and traps air bubbles, producing milky-colored ice. If the air is warmer, water freezes slowly on the hailstone, air escapes, and the ice is clear.

Hail production in thunderstorms is favored when the updrafts are strong and deep. Such conditions are more likely to occur when the instability is high in the

atmosphere. Relatively high cloud liquid water contents also favor the development of hail. Hail is encouraged when the updraft is wide and very twisted. Hail kills few people but can cause substantial property damage. Large hail often causes broken windows as well as damage to roofs and walls. Damage to automobiles and aircraft can be especially costly. Livestock may also be killed or injured. Meteorologists cannot count on hail to be unambiguously apparent on Doppler radar. Thus, warnings specific enough to avoid property damage are not common.

In addition to the conditions that favor thunderstorms in general, tornadoes, strong straight-line winds and hail are promoted by strong vertical wind shears, including changes in wind direction with height. Yet the climatological distribution of these events shows that much is not known about the formation processes of these storms. Large parts of the world experience few or no tornadoes—most of Africa, South America, and Asia. The occurrence of hail, however, is much more widely distributed. In many parts of the world, hail occurs more frequently in regions in or near mountain ranges. Florida has large numbers of tornadoes but very little hail. Northern INDIA and PAKISTAN have a lot of hail but few tornadoes. In the United States, strong straight-line winds are preferred in the northern plains as opposed to the southern plains. This distribution differs from those of both hail and tornadoes. Many individual storms will have more than one type of severe weather. Developing a method for determining what type of types of severe weather a particular storm will produce is a goal for storm researchers.

Heavy precipitation does not have a precise definition because the amount of rainfall that would be hazardous varies from one location to another. The primary hazard of heavy precipitation is flash flooding. A location with an abundance of vegetation is able to absorb more rainfall than one with sparse vegetation. A location with steep slopes funneling water to a particular spot is more vulnerable to flooding than a relatively flat region. Thus, precise definitions of heavy precipitation vary from nation to nation and even within the same nation.

Heavy precipitation is more likely to come from multiple cell thunderstorms. Individual ordinary cells don't last long enough. Supercell thunderstorms tend to be less efficient at producing precipitation. Although heavy precipitation is produced under some of the same circumstances as the severe weather types mentioned above, its most ideal environment has weak winds and little vertical wind shear throughout the tro-

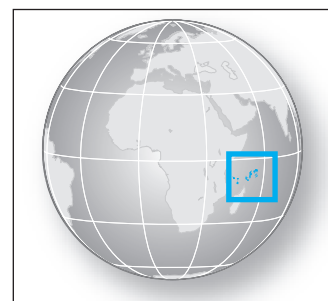
posphere. The storms move slowly relative to the ground. They may reform over the same area if a fixed feature, such as a mountain range, is acting as a trigger. Alternatively, new thunderstorm cells may form in a direction nearly opposite to the one that the storms are moving toward. Even though other types of severe weather sometimes occur, heavy precipitation often takes place in situations that are not suitable for the development of other severe weather.

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## Seychelles

**Map Page** 1116 **Area** 177.5 square mi (455 square km)  
**Population** 80,469 **Capital** Victoria **Highest Point** 2,986 ft (905 m) **Lowest Point** 0 m  
**GDP per capita** \$7,800 (2002) **Primary Natural Resources** fish, copra, cinnamon trees.



AS A RESULT OF competing colonial claims for dominance in the INDIAN OCEAN, the island republic of the Seychelles displays an intriguing mixture of indigenous, French, and British characteristics. The population speaks a Creole, and laws are a combination of French civil law, English common law, and customary law.

Since independence from the UNITED KINGDOM in 1976, the Seychelles has steered its own course, through a period of one-party socialism to one of leadership in tourism and "positive nonalignment" in the Indian Ocean region.



The Seychelles consists of a chain of 40 granitic islands and about 50 coralline islands, concentrated in six groups. Stretching across 744 mi (1,200 km) of open ocean, from Île aux Vaches in the northeast to the Aldabra Islands in the southwest, the length of the chain gives the country claims to jurisdiction and fishing rights over 620,000 square mi (1 million square km) of ocean. Most of the granitic islands lie within 56 mi (90 km) of the largest island in the group, Mahé, on which is the capital city of Victoria, the nation's only city and one of the best ports in the Indian Ocean, strategically located at the center of a triangle between Mombasa (KENYA), MUMBAI (INDIA) and MAURITIUS. Mahé and the other major islands—Praslin and La Digue—are hilly, with narrow coastal plains, and ringed with coral reefs. They are the peaks of the submarine Mascarene Plateau. Some 99 percent of the population lives on these three islands, mostly on Mahé.

The coralline islands are very flat, have little fresh water, and are mostly unpopulated. They are either sand cays or uplifted coral reefs and are important ecological zones as breeding grounds for rare marine life, seabirds, and the giant tortoise. A system of national parks and animal preserves, supported by the World Bank, now covers 42 percent of the land area and 64,200 acres (26,000 hectares) of the surrounding seas, established to protect hundreds of animal and plant species found nowhere else.

The islands were visited by traders from the PERSIAN GULF and East Africa, then by Portuguese in the 16th century. The French claimed the main islands in 1742, and named them for the minister of finance, Jean Moreau de Séchelles. Not intended as a plantation colony, the islands were instead used as a reprovisioning stopover for passing trade ships, relying heavily on the turtle population for meat. Britain took over the islands in 1814 and gradually extended control over the smaller islands and coral atolls to the southwest. Governed as a dependency of Mauritius at first, the island chain became a separate colony from 1903 until independence in 1976. The Seychellois people are a fairly homogeneous mixture of African and European descent, with small numbers of immigrants.

Underdeveloped as a colony, and lacking any real space for agriculture, the Seychelles has turned to tourism as its mainstay since independence, employing about 30 percent of the workforce and providing about 70 percent of the nation's gross domestic product (high by developing world standards). Fishing is also of major importance, and Victoria's tuna canneries are among the largest in the world.

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## Shanghai

SHANGHAI IS CHINA'S "second city," and is a leader in the economic transformation of 21st-century China. Developed in the 19th century as imperial China's main outlet to the West, the city became one of the world's greatest marketplaces, as well as a sophisticated cultural center known as the Paris of the east. But it has also been labeled the New York of the east, as a city that rivals its national capital in importance in everything from population to economic power to cultural dominance. But the city is best known today as the dragon head, owing to its position at the mouth of China's greatest river, and as the driving force for China's economy.

Shanghai—meaning "on the sea"—is located where the Yangzi River (CHANGJIANG) meets the East China Sea. Though not actually located on the sea, the city's location about 10 mi (16 km) up the Huangpu River shield it from the more dangerous waters of the mouth of the Yangzi (about 25 to 30 mi or 40 to 50 km), subject to floods and high winds. The 37-mi (60-km) waterfront along the banks of the Huangpu sees about one-fourth of all of China's oceangoing cargo, most still carried locally by traditional sailing junks (*fanchuan*). The Yangzi is China's main east-west artery, navigable as far as Chongqing, 3,900 mi (6,290 km) upstream.

Control of this area meant control of most of China, a fact well known for centuries by waves of imperial dynasties, followed by European colonialists in the 19th century and Chinese Nationalists, Japanese occupiers, and the Communist Red Army in the 20th century. The British capture of the Yangzi delta in 1842 forced China's government to open its first port to Western traders. Communist occupation of the region in 1949 spelled the end of Nationalist government on the mainland.

Returning to its roots, Shanghai was one of the first Chinese cities opened for foreign investment in 1984, and the adjacent city of Pudong became one of six



Shanghai is China's "second city" and is a driver of the economic transformation of 21st-century China.

Special Economic Zones, with relaxed import/export regulations and lower taxes, in 1993.

With Jiangsu Province to the north and Zhejiang to the south, Shanghai and the surrounding countryside forms its own district, one of China's four *shi* (or municipalities), equivalent in administrative status to a province. The largest city in China, the district's 2,473 square mi (6,314 square km) is home to nearly 14 million people, making it the 16th-largest metro area in the world. The city proper ranks at number 11, with 9.1 million inhabitants. Shanghai's population density is about five times that of Beijing. Too many people and too many factories are causing this city built on a marshy delta to slowly sink into the sea, so efforts are being made to pump water back into the soil and to redistribute a lot of its people and industries more evenly around the region, specifically in Pudong, east of the Huangpu.

Shanghai has been a market town for centuries, officially recognized as an imperial city in 1159. In the 18th century it grew rapidly as the center of the Chinese cotton and fabric industries. Until World War II, Shanghai was divided into Old Shanghai (around the districts of Nantao, or Nanshi, and Chapei), and the International Settlement. The International Settlement was an essentially self-governing enclave of European commercial colonies, separate from the Chinese city (physically, by a moat), with its own schools, municipal officers, and police systems. Many older residents who were raised and educated in this sector still speak English or French and practice Christianity.

One of the most recognizable sights in East Asia is the commercial strip along the Huangpu known as the Bund (now called Zhong Shan Road), which resembles Liverpool, England, more than it does any other Asian waterfront. The British were the first to establish trade here in the 1840s, followed by factories from the 1890s. Over half of pre-World War II Chinese industry and nearly all of its banks were located in and around Shanghai. The Nationalist Chinese government began to develop the Chinese part of Shanghai into a model city during the 1930s, with new municipal buildings, libraries, museums, and medical centers. The Japanese invasion and occupation from 1937 put a stop to this growth, and the war devastated much of the region's trade and industry.

The city is strategically located between China's north and south and retains strong ties to the Chinese diaspora across the Pacific Rim. These advantages naturally stimulated Shanghai's economic boom since the loosening of central government control in the early 1990s. Shanghai now boasts the highest concentration of educated workers, especially in science, technology, and management. Local industry focuses on automobiles, iron and steel, petrochemicals, power equipment, telecommunication, and electrical appliances. Nearly \$17 billion in foreign investment has transformed it into a glittering city of skyscrapers, but problems remain in the growing disparity between rich and poor and in the still-heavy government regulations emanating from Beijing.

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## shield

A SHIELD IS A large, tectonically inactive mass of Precambrian crystalline rock that underlies most of a continent. (Another name for a shield is craton.) A shield's rocks are igneous and metamorphic in origin and contain some of the oldest rocks on Earth. In zones of tectonic plate convergence, mountain systems that are actively building often mark the edges of shields.

Younger-aged sedimentary rocks hide large areas of most shields. The younger rocks, ranging in age from the Paleozoic through the Cenozoic eras, accumulated during times when large inland seas covered the shields. The marine rocks can be thousands of feet thick. Fluvial and glacial erosion have exposed parts of the shields. The topographic surfaces of the exposed areas include plains, low hills, and low plateaus, although there are exceptions where tectonic forces cause large crustal blocks to uplift. Erosion has exposed parts of all continental shields, aside from the East Antarctic shield, which an ice sheet totally covers.

The CANADIAN SHIELD, which underlies most of North America, is a good example of a partially exposed shield. A Pleistocene ice sheet, which existed between about 1.8 million and 15,000 years ago, eroded and exposed the northern half of the shield. The exposed area surrounds Hudson Bay and consists mostly of the Laurentian Plain. The plain is a low-lying surface pockmarked with glacial lake basins, bare rock, thin soils, and a helter-skelter veneer of assorted glacial deposits. A thick mantle of glacial deposits overlying marine sedimentary rocks covers the shield immediately south and west of the Great Lakes basins. The glacial deposits end at the Ohio and Missouri rivers, but the marine sedimentary rock cover continues farther south and west.

The break up of Pangaea gave rise to northern and southern shields: the Laurasian shields and Gondwanan shields, respectively. The Laurasian shields include the Canadian Shield; the Greenland Shield; the Scandinavian Shield in NORWAY, SWEDEN, FINLAND, northern Europe, western RUSSIA, and UKRAINE; and the Siberian Shield in north-central Russia and Central Asia. The Laurasian shields have areas exposed due to recent (Pleistocene) glaciations. The Gondwanan shields include the Brazilian and Guyana shields in South America as well as the African, Indian, and Australian shields. Glaciations partly exposed the Gondwanan shields before Pangaea's breakup (225 million years ago). Exposures that are more recent are due mainly to fluvial erosion.

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## shifting cultivation

OF THE MANY different types of agriculture that exist worldwide, shifting cultivation is today most common in forested tropical and subtropical regions. It was once much more widespread in areas where permanent agricultural systems now exist, such as the temperate and Mediterranean zones, as agriculture emerged from hunting and gathering and spread from centers of origin in the Near and Far East.

It involves the clearance of a small plot of land that is cultivated for a few years until declining fertility causes the farmer to move to on and repeat the process. The abandoned plot then recovers its fertility as the forest recolonizes during a fallow period. The continual relocation of cultivation underscores a nomadic lifestyle.

Today, shifting agriculture supports between 300 and 500 million people who comprise indigenous groups with an intimate and inherited knowledge of the land and a relatively new group of cultivators who have abandoned the poor environments of fast-growing cities in developing countries in favor of a life in the forests. The latter lack expertise; their efforts often cause environmental problems and harvests are usually below those of the experienced farmers. Shifting cultivation is considered to be a major cause of deforestation in the tropics.

The first stage in shifting cultivation is the removal of the natural forest. This involves cutting and usually burning, processes that have generated the term slash-and-burn. Good management involves selective rather than complete tree removal. Trees that produce a fruit or oil crop, or provide fodder, shelter and firewood, are retained. They provide protection for the soil and a source of seeds for forest renewal after cultivation is abandoned. Stumps of other species may also be retained for the same reasons. Controlled firing clears surface twigs and ground plant species and is best undertaken toward the end of the dry season so that crop planting can take advantage of the first rain. The burning of biomass, that is, the organic material of the vegetation, creates ash, the nutrients in which are generally soluble and so enter the soil with percolating rainwater.

Thus, burning speeds up nutrient cycling in the ecosystem by accelerating their release from the biomass which would otherwise decompose relatively slowly. Immediately following firing, the land is at its most fertile because of this nutrient availability, but the soil is at its most vulnerable because the lack of a vege-

tation cover exposes it to the impact of wind and rain. At this stage erosion should be minimized through the maintenance of some of the natural vegetation, that is, the trees referred to above, and rapid crop planting.

Other soil conservation measures include the siting of logs or soil dams horizontally where land is sloping. These measures contribute to the equally important management of nutrients, most losses of which occur at the vulnerable stage between burning and planting, and often when heavy rains are beginning. Leaching of nutrients through soils and below the root zone means that they are unavailable for plant growth and are effectively lost from the system. Good nutrient management also requires the retention of crop residues in the cultivated plot so that nutrients are returned to the soil when they decompose. Weed control through hoeing is also necessary.

In most shifting cultivation systems a variety of crops are grown, each with different nutrient requirements and each having a specific use. Each farmer aims to grow sufficient crops for the family for food, medicine, and possibly fiber and fuel, as well as fodder for a few animals that supply all-important proteins such as milk and eggs. This is a form of subsistent agriculture that is essentially noncommercial. However, some subsistent crop farmers may interact with nomadic herders, as on the margins of crop growing in sub-Saharan Africa, with the effect that carbohydrate-rich crops are traded for the nutrients of animal manure.

Plot fertility declines rapidly and farmers move on after two to three years and repeat the process elsewhere. Forests recolonize the abandoned plot. Provided that cleared plots are not too large, forests will reestablish in about 15 to 20 years.

The trees-soil-litter relationship will have been reconstituted and a large store of nutrients built up in the vegetation and the litter. Indeed, many trees have shallow roots that facilitate nutrient recycling between the litter and the vegetation, with the soil contributing only a small nutrient pool. Subsequent burning for cultivation disrupts this relationship, but the system can be sustainable over long periods if the fallow period is sufficiently long. Where reburning occurs within too short a period, caused by increasing populations and land shortage, productivity of the plot declines and harvests are poor.

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## Siberia

SIBERIA, INCLUDING the Russian Far East, covers 4.9 million square mi (12.8 million square km), an area that is three-fourths of the Russian Federation or one-third larger than the UNITED STATES and one-fourth larger than CANADA. Siberia stretches from the URALS in the west over 3,000 mi (5,000 km) to the PACIFIC OCEAN in the east. It has borders with KAZAKHSTAN, MONGOLIA, and CHINA. In the very unlikely case that Siberia would separate from the Russian Federation, it would become a large state by its territorial size, but with a sparse population. Siberia's size is not advantageous as the climate is usually very harsh with a marked continental climate. The northeastern part shows the coldest temperatures in the Northern Hemisphere with -90 degrees F (-68 degrees C) at Oymyakon and Verkhoyansk in Yakutia. In summer, temperatures can reach 90 degrees F (32 degrees C).

These great differences in temperature present a challenge for human colonization and exploitation of the rich natural resources (wood, coal, oil, gas, gold). Permafrost has a decisive impact on soil formation with the consequence that infrastructure is expensive to build. Therefore, the famous Trans-Siberian Railroad, built between 1891 and 1903, touches the southern belt of Siberia. Although Siberia is inhabited by nearly 45 different ethnic groups, Russians represent the majority. According to the census of 1989, 85 percent of the population are Russians. Russian colonization since the late 16th century resulted in a decline of the indigenous nationalities that counted more than 200 tribes before the Russian arrival. There are three great ethnic groups: Finno-Ugrians, Turco-Tatars, and Tungus and Paleo-Asiatics.

In the Middle Ages, Siberia was a part of Genghis Khan's Mongol empire. At that time, the Siberian khanate kept up trade relations with Central Asia and China. The Russian push to the east was motivated by





*Siberia covers three-fourths of the Russian Federation and is one-third larger than the United States and one-fourth larger than Canada. If it were its own country, it would be among the larger nations, but only with a very sparse population.*

the search for furs and is associated with the legendary Cossack leader Yermak. Historians compare the Russian colonization of Siberia with the opening up of the North American frontier by British, French, and Spanish colonizers. Like in North America, settlers installed fortified settlements (in Russian: *ostrogi*). The Treaty of Nerchinsk (1689) allowed China to maintain its territorial sovereignty over the Amur region. This, however, changed, in the mid-19th century when East Siberian Governor-General Nikolai Murav'ev-Amurskii annexed the borderland for RUSSIA.

In 1860, China had to cede the coastal province (today Primor'ye) where the Russians founded the harbor of Vladivostok. After the peasant liberation in European Russia (in Siberia serfdom did not exist), the "great migration" of nearly 5 million peasants from the UKRAINE and central Russia began. This process

was facilitated by the construction of the Trans-Siberian Railroad. Migration, railroad construction, and expansionistic aims in nearby Manchuria moved Russia into conflict with JAPAN. Russia's "manifest destiny" in the east suffered a heavy defeat in 1905 by Japan, the rising power in the Far East.

The late 19th century also saw the awakening of a Siberian regionalism. One of Siberia's influential intellectuals, N.M. Yadrintsev, argued that Siberia was closer to America and Asia than to the Russian heartland. However, the October Revolution of 1917, the Civil War, and Stalinism strangled all thoughts of Siberian autonomy. In the 1930s and during World War II, Siberia became an important "resource frontier." After the occupation of the Ukraine by German armies, the Kuznetsk Basin (Kuzbas) was the main coal producer of the Soviet Union. By 1940, before the Ger-

man attack, Siberia was producing 95 percent of tin, 80 percent of tungsten, and 70 percent of molybdenum used in the Soviet Union. Between July and November 1941, the great evacuation of manpower and factories from European Russia behind the Urals began. Siberian industry produced military equipment like tanks and bombers.

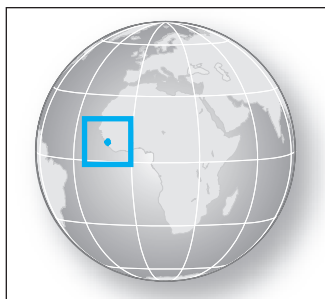
However, industrialization of Siberia in the 1930s and 1940s is also connected with the Gulag prison system. Alexander Solzhenitsyn estimated that there were 225 labor camp regions, stretching over the vast lands of Siberia like an archipelago. In this “empire” nearly 40 million persons did work, 4 to 6 million of them in the Kolyma camps of the far northeast. From 1950 until the 1970s, great technical projects like Bratsk dam, the Baikal-Amur magistrale (BAM), and the discovery of the oil and gas fields in western Siberia (Surgut) were realized under the tutelage of Akademgorodok, Siberia’s science city near Novosibirsk. In 1973, during the Arab oil embargo, western Siberia exported via the BAM 70 percent of its oil production to East Asian and Pacific Rim countries. However, these megaprojects meant a deep challenge to the natural environment and eroded traditional life of the Siberian natives.

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## Sierra Leone

**Map Page** 1113 **Area** 27,699 square mi (71,740 square km) **Population** 5,732,681 **Capital** Freetown **Highest Point** 6,390 ft (1,948 m) **Lowest Point** 0 m **GDP per capita** \$500 **Primary Natural Resources** diamonds, gold, titanium ore, bauxite.



**LOCATED ALONG** the north ATLANTIC OCEAN in western Africa, Sierra Leone borders the Republic of GUINEA and LIBERIA. Most of the country’s coastline is made up of a belt of low-lying mangrove swamps broken here and there by numerous estuaries and some wide, sandy beaches.

The exception to this is a mountainous zone on the Sierra Leone Peninsula, where the capital, Freetown, is located. Behind the coastal belt is a wooded plateau that averages about 1,000 ft (300 m) in height. The eastern half of the country toward the Guinea border is relatively mountainous and includes Bintimani Peak, Sierra Leone’s highest point at 6,390 ft (1,948 m).

Several rivers, including the Great Scarcies and the Mano, flow through the country to the Atlantic. The headwaters of the NIGER RIVER are also situated in the mountains of the northeast. The landscape has several distinctive physiographic regions: a low-lying, relatively flat coastal-swamp zone along the Atlantic that is subject to frequent flooding; the Sierra Leone Peninsula, a region of thickly wooded mountains that rise from coastal swamps to an elevation of 2,913 ft (888 m) at Picket Hill; the featureless interior plains with broad grasslands, rolling wooded country, and a rocky scarp and hill country; and a large plateau region that includes the Loma Mountains, crowned by Mount Loma Mansa (Bintimani Peak) and the Tingi Hills, which rise to 6,079 ft (1,853 m) at Sankanbiriwa Peak.

### WET AND DRY SEASON

The climate is definitely tropical with high temperatures and humidity. Normal rainfall can be quite heavy especially during the Atlantic’s hurricane season. Along the coast where rainfall is the heaviest, especially on the Peninsula Mountains, as much as 200 inches (5,080 mm) may fall annually. The dry season lasts from November to April, and the wet season constitutes the remainder of the year, with maximum precipitation from July to September.

Sierra Leone is self-sufficient in timber and about one-tenth of the land is arable and roughly 30 percent of the total land is committed to permanent pasture. Mineral resources are fairly widespread. Alluvial diamonds can be found along the upper reaches of the Sewa River where they have been mined since the 1930s. Other important mineral deposits include iron ore, bauxite, chromite, and rutile.

In 2002, the country ended a decade of civil war through the efforts of British and United Nations peacekeeping forces. The peacekeeping forces were able to disarm thousands of rebels and militia fighters.

Into the 21st century, the country is undergoing a rebuilding process, including the formation of a Truth and Reconciliation Commission to address atrocities committed by the warring factions.

Black settlers founded the capital city, Freetown, under the auspices of the British. The first settlers were known as the Black Poor, a group of 400 people from England in 1787. Shortly thereafter, former slaves from Jamaica and other parts of the Caribbean arrived in Freetown; they had gained their freedom by fighting with the British during the American War of Independence. The descendants of Sierra Leone's black settlers blended African and British lifestyles into a distinctive Krio, or Creole culture. Besides speaking English, they developed their Krio language, which has become the nation's lingua franca. Today, the Krio make up only 5 percent of the country's multiethnic population.

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## Silk Road

BETWEEN MESOPOTAMIA and CHINA stretched Central Asia, large, barren, hostile—a wasteland. Through this vast area, the one link that allowed the two civilizations to trade with each other was the loosely defined cluster of trails known as the Silk Road. Even today, the Silk Road runs through one of the harshest desert environments in the world, with little water or vegetation or life. It is sandy, and sandstorms bury everything in their way. The local inhabitants refer to the Taklimakan Desert as “the Land of Irrevocable Death.” Locals stayed near the Silk Road and the other paths around the edge of the desert.

Northeast of the Taklimakan is the GOBI DESERT, less desolate and dry, but still formidable. To the south are the HIMALAYAS, Karakourum, and Kunkun, the highest mountain ranges in the world. Another barrier between west and east is the PAMIR KNOT, several mountain ranges, including the TIAN SHAN and Pamir.

The easiest access from the east is by the comparatively fertile Gansu Corridor, which lies between the Tibetan High Plateau and the Gobi Desert and Mongolian plateau. Travelers from the south had to cross ice-laden passes in the Himalayas and the Pamir Knot.

China and Mesopotamia developed civilization and commerce, Mesopotamia first, with China developing later because the terrain was more difficult. The Qin Dynasty established a central government for the individual states. The capital was at Changan (present-day Xian). The Han Dynasty first explored to the west, when Zhang Qian sought to ally with the Yuezhi tribe in the west. The 13-year journey began in 138 B.C.E. He returned with no ally but with information about horses and tribes hitherto unknown. The emperor sent more expeditions in search of horses and luxuries. Although Zhang Qian is titled as the father of the Silk Road, he was not the first explorer. Even before, Chinese merchants were providing small amounts of Chinese goods to the west via the Silk Road.

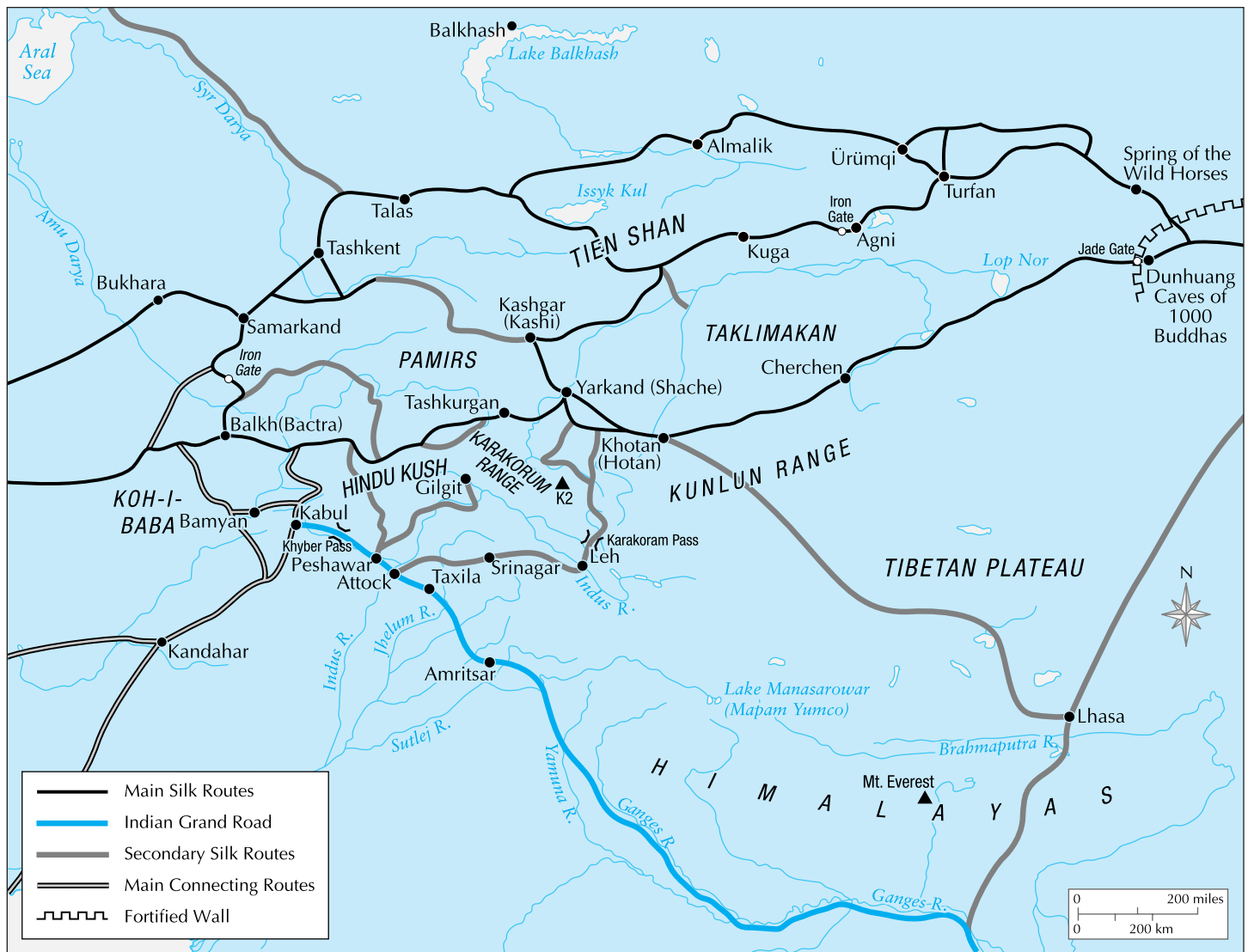
### BANDITS AND OASES

The road was not one single road but many roads along a general east-west path. Some were relatively well developed, while others were primitive. Some were safer than others from bandits. Some had more oasis towns. The merchant had choices. Would he take the route along the southern edge of the Taklimakan? It was extremely dangerous but faster.

Many of the routes met at Kashgar (Kashi), at the foot of the Pamirs. Kashgar was one of the most important centers of trade in Central Asia. It was the halfway point, the meeting place for most traders to sell their goods to middlemen and buy new for the return trip east or west. The goods traveled the road to a greater extent than the merchants did.

The Silk Road trade included items other than silk, even though silk was most prized by Westerners. Items such as precious metals and stones, ivory, and glass made their way toward CHINA; in return, ceramics, jade, bronze, lacquer, and iron goods and gunpowder made their way to the West. All traveled by caravan from 100 to 1,000 camels in size. Each camel bore about 500 pounds of goods. Caravans attracted bandits, so armed escorts went along with them.

The Gansu Corridor was natural terrain for ambushes and hold ups. Trade suffered, and merchants at both ends took great losses. The Han built forts and walls along this part of the route. The walls combined later to form the Great Wall. The wall along the north side of the Gansu corridor failed to provide adequate



*The Silk Road (Central Asian portion, above) was not one single road but many roads along a general east-west path. Some were relatively well developed while some were primitive. Some were safer than others from bandits. Some had more oasis towns.*

control, so the late Han rulers established local government, especially in the Taklimakan region.

Trade was secure, reliable, and profitable, and settlers absorbed some of the local culture as well as that of the merchants along the road. The road brought Buddhism from INDIA to China by the first century C.E., with monasteries and pagodas along the road. Christianity came along the road to China in the 7th century C.E. During the 7th century Tang Dynasty, the road peaked in use. Buddhist influence grew, and states along the way assimilated to Chinese ways. By 742, Changan was a city of 2 million, including Japanese, Koreans, Malays, and foreigners on the road. Genghis Khan in 1206 established the Yuan Dynasty. For 160

years as the world's largest empire, it stretched from China to Persia and to the Mediterranean. The Silk Road was a vital communications link as well as a trade route. Mongol rule was a time of toleration for the diversity of religions and nationalities. Europeans began entering the east with the travels of Marco Polo.

The empire declined from internecine conflict in the 1260s. The Ming Dynasty retook China in 1368 and turned China toward nationalism and isolationism. ISLAM revived in the west and blocked the road. Trade by sea became safer and more profitable. And European demand for eastern silk diminished as the local product improved. Most of all, with time the deserts overwhelmed the settlements, which lacked the



resources to maintain wells, buildings, and streets, especially when confronted by increased banditry and decreased trade. Slowly the towns and religious sites lost the battle to the sands. In the 19th century, British and Russian merchants and scholars revived interest in the road.

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## Sinai, Mount

LOCATED IN EGYPT on the SINAI PENINSULA, Mount Sinai has a height of 8,651 ft (2,640 m) and is known locally as Gebel Musa (Mountain of Moses). This granite mountain has long been associated with the area described in the Judeo-Christian Holy Scriptures as the setting where God revealed himself to Moses in a burning bush (Mount Horeb) and later provided him with the Ten Commandments (Mount Sinai). Jewish scholars have a tradition of considering the exact location of the Mount Sinai mentioned in the Pentateuch as being unknown or hidden. Contemporary religious and historical scholarship is in contention about the exact location of this holy mountain.

In the first centuries of Christianity, desert monasticism was a common expression of the search to know and serve God. Conflict with the Roman state put additional pressure on the devout to flee to remote areas. It is understood that several monks lived in the vicinity of Gebel Musa in seclusion and retreat as early as the third century. These humble hermits are given credit for first associating Gebel Musa with the Mount Sinai of scripture.

In 337 C.E., the empress Helen, mother of Constantine the Great, had a church built on the traditional site of Moses's burning bush, endorsing the location's authenticity and establishing the long association with the Orthodox Church. This chapel became a popular pilgrimage site and a monastic community formed around it. In about 537 C.E., the Byzantium emperor

Justinian had a fortresslike monastery built to ensure the protection of pilgrims and monks. It was called the Monastery of Transfiguration. The stability this brought to the community allowed the collection and creation of priceless religious and artistic treasures over the centuries.

Throughout its long history, the monastery has received gifts from the popes of Rome, Christian royalty, and especially from the tzars of RUSSIA. The imperial tzars took up the Orthodox mantle of leadership after the fall of the Byzantine Empire. The monastic community is a Greek Orthodox one but has always had the blessing and support of the Russian Orthodox Church. Muhammad, the prophet of ISLAM, also saw fit to preserve the monastery, providing a written edict of protection signed with his hand print.

The monastery was associated with Saint Catherine of Alexandria in the 9th century. Tradition holds that Saint Catherine was a young woman of Alexandria martyred by the Roman emperor Maximus for her Christian faith in 305 C.E. A monk of the monastery was lead by a vision to the uncorrupted body of Saint Catherine atop the highest peak nearby, Gebel Kate-rina. Saint Catherine was then incorporated into the history of the mountain and the monastery.

The Monastery of Saint Catherine is set below Mount Sinai and has been a focus of pilgrimage for more than 15 centuries. Within its impressive and picturesque walls are significant collections of ancient manuscripts and icons, said to be surpassed only by holdings of the Vatican in Rome. The Monastery of Saint Catherine is one of the earliest remote Christian monastic communities and certainly the oldest to have survived intact and still in use as a spiritual community. The mountain has been recognized by the United Nations as a World Heritage Site.

Mount Sinai has several venerated sites on its craggy ascent. At the peak is the Chapel of the Holy Trinity, first erected in the 4th century and subsequently rebuilt more than once over the centuries. Below the summit is a plateau known as Elijah's Basin, purported to be the place where the biblical prophet Elijah sought God's presence. Also nearby is the spot where Aaron and the 70 elders of the tribes of Israel waited while Moses received the laws of God, the Ten Commandments.

The remote location that had served to protect and preserve this unique site of world culture is now accessible by roads carrying tour buses. Mount Sinai has become an important part of Egypt's tourist trade. The government of Egypt is undertaking efforts to preserve

the ecology and cultural aspects of Mount Sinai and its surrounding area.

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## Sinai Peninsula

THE SINAI PENINSULA (in Arabic, the Shibh Jazirat Sina) is the eastern extension of EGYPT onto the continent of Asia (Egypt being mainly in Africa), bordering on the country of ISRAEL. The western boundary of the peninsula is formed by the Gulf of Suez and the Suez Canal, while it is separated from SAUDI ARABIA and JORDAN to the east by the GULF OF AQABA. The southern tip of Sinai points into the RED SEA, while the eastern MEDITERRANEAN SEA bounds its northern shores.

The Sinai Peninsula is 23,400 square mi (67,000 square km) in area, with a population of approximately 300,000. The land is arid, with relatively few oases at which the bulk of the population is located, although there are also Bedouin following a nomadic lifestyle with their tents and herds. Its physical geography is characterized by three major regions: the sandy coastal plain of the north, the high limestone plateau in the center, and the mountains of the south.

These mountains are associated with the biblical account of the flight of the Hebrew people from Egypt. This event is generally believed by scholars to have taken place during Egypt's New Kingdom period, and some scholars have suggested Ramses II as the pharaoh of the Exodus account. According to the Exodus narrative, the Hebrews trekked southward from their crossing of the Red Sea to Mount Sinai, also known as Mount Horeb. There they encamped while God gave Moses the Ten Commandments, enscribed on two tablets, as well as various other laws.

Traditionally the biblical Mount Sinai has been identified as an 8,000 ft (2,400 m) peak near the southern tip of the peninsula, known in Arabic as Jabal Musa (the Mountain of Moses). Several religious communities have been located on or near it over the cen-

turies, including a Greek Orthodox monastery and a Sufi school. However, some modern scholars have suggested, based upon new understanding of the Hebrew language, that the actual Mount Sinai may be another peak farther to the north.

In modern times, the Sinai Peninsula was first formally associated with Egypt by the Islamic empire which arose in the 600s, shortly after the life of Muhammad. This association with Egypt was formalized in the 1906 agreement between the United Kingdom and the OTTOMAN EMPIRE (modern Turkey), which set many of the critical boundaries in the Middle East.

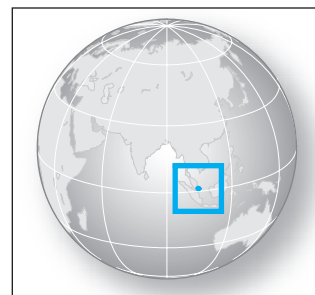
It became the locus of further conflict following the 1948 establishment of the state of Israel, and after the 1967 Arab-Israeli War, it was occupied by Israeli forces. In 1982 Israel withdrew its forces in return for Egypt's recognition of Israel's right to exist, in accordance with terms set down in the 1978 Camp David accords brokered by U.S. President Jimmy Carter. However, a dispute at Taba on the Gulf of Aqaba continued until 1989.

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## Singapore

**Map Page** 1124 **Area** 430.4 square mi (692.7 square km)  
**Population** 4,608,595 **Capital** Singapore  
**Highest Point** 545 ft (166 m) **Lowest Point** 0 m  
**GDP per capita** \$20,733 **Primary Natural Resources** rubber, copra, fruit, vegetables, orchids, poultry.



THE REPUBLIC OF Singapore consists of a main island and a group of 58 islets. It is situated in Southeast Asia, only 85 mi (136.8 km) north of the equator. The diamond-shaped main island, accounting for 90 percent of country's area, is connected by a causeway with MALAYSIA and mainland Asia. During World War II, the Japanese surprised the British by invading Singapore

by land using this causeway. For four years, until 1945, Singapore was occupied by JAPAN. Singapore was founded as a British colony in 1819 for trading purposes.

Its highest point is at the central part of the main island, though it is mainly a low-lying island country not much above sea level. Singapore is a country with an equatorial climate and with 96 in (240 cm) of annual rainfall; no month receives less than 6 in (10 cm). The temperature remains uniform year-round, the mean daily being 75 degrees F (23 degrees C).

Its population of 4.6 million (2003) has an equitable male/female ratio; a low birth rate (-12.75 per 1,000); and a fertility rate of 1.24, indicating a negative natural growth through a high net migration rate of 26 per 1,000, which caused a significant positive growth in 2003. Singapore is ethnically diverse, with 78 percent Chinese (Buddhist), 14 percent Malays (Muslim), and 7 percent Indians (mainly Hindu). Ethnic and religious harmony has been maintained. Singapore was a British colony until 1963, when it was joined into a federation with Malaysia.

In 1965, it seceded from the latter and became an independent country. It introduced parliamentary democracy. Since 1965, the Peoples Action Party (PAP) has dominated the parliament resulting from democratic elections that take place every five years. The last parliamentary election was held in 2001; Chok Tong, first elected as prime minister in 1990, was elected for the third term. The PAP has introduced an innovative economic policy of egalitarianism offering a Fabian-style socialist system guaranteeing a minimum economic level to everyone.

Singapore's healthy free market economy, corruption-free society, and stable democracy make it an attractive investment haven in Asia. The state-sponsored Housing Planning Board houses 9 out of every 10 in the country mainly in modern apartments in high-rise complexes. Singapore has turned from a developing country in the 1960s (the per capita gross domestic product [GDP] in 1960 being \$280) to a developed country with a per capita GDP of \$20,733 in 2003.

Taking advantage of its crossroads location between the INDIAN and PACIFIC oceans, it has turned into the world's busiest container port and one of the busiest world ports in tonnage. It is a manufacturing center for electronics and metal products, chemicals, petroleum refining, and transport equipment. Being a city-state, agriculture is not important. Apart from machinery and equipment, mineral fuel and chemicals, it imports almost all the required foodstuffs. Singapore is

also a notable financial and economic center. It has had a thriving stock market since the 1970s and is on its way to becoming Southeast Asia's hub for financial and high-tech activities. Singapore's downtown has been converted into a modern skyscraper city. The three most impressive skyscrapers are by the side of the Singapore River—Overseas Union Bank, United Overseas Bank and Overseas Chinese Banking Corporation. Since the end of 1980s, it has introduced an underground metro or subway system.

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## Skeleton Coast

THE SKELETON COAST is part of Africa's southwestern coastline. It runs from NAMIBIA's Cape Cross north to the Kunene River. Much of the plant, insect, and animal life here has adapted to a continued shortage of fresh water because most of the coast is part of the Namib Desert. Many species have unique ways to harvest water from morning fogs, helping them to survive this harsh and dry environment.

The frequent thick fogs, strong currents, and ever-changing coastline have helped to give this stretch of dangerous coast its name. Many sailors have shipwrecked on the Skeleton Coast. The salty air makes quick work of the thin wood and metal around the hulls of the ships, usually leaving a wooden or metal skeleton that takes years to rust or rot away. Further inland, the skeletons of unlucky sailors who were probably searching for water are often uncovered in the sands by wind. The land is harsh and fresh water is scarce and hard to find, especially if the territory is unfamiliar.

Part of the Skeleton Coast has been designated the Skeleton Coast Park, a wildlife refuge. Animals are safe from hunting inside the park, but some conservation-

ists say the park is too small, requiring animals to migrate out of its protection in search of food and water. Because most of the Skeleton Coast is part of the 1,250-mi- (2,000-km-) long Namib Desert, the coast receives less than .75 in (2 cm) of rain annually, and the only perennial river in the area is the Kunene. Deep gorges and valleys give hints of other rivers that flow during the infrequent rains.

Some rivers will reach the sea at times, but more often run dry before they can traverse the desert. Sand dunes run inland from the coast, and coastal winds sculpt them into long ridges and crescent shapes known as barchans. They can rise to more than 1,300 ft (400 m) and can creep across the desert floor at up to 50 ft (15 m) a year. A strange characteristic is the groaning and rumbling noises these dunes make as sand cascades down their steep slopes.

Despite the harsh conditions, life thrives along the Skeleton Coast. Cape fur seals have established colonies on the beaches and countless birds fish the rich coastal waters. Elephants, giraffes, zebras, chacma baboons, hyenas, and antelope also call the Skeleton Coast home, using the dried riverbeds as game trails and to hunt for food. Water along the riverbeds usually lies underground, within the reach of plant roots, giving inhabitants nutrition and cover. Animals will also often migrate to the few permanent freshwater holes.

Despite the tropical latitude, offshore waters are chilly, usually below 60 degrees F (15 degrees C). The cool, Antarctic BENGUELA CURRENT helps to bring down the temperature of the coastal waters and condense the humid air that blows in from other parts of the ATLANTIC OCEAN. This causes a thick morning fog that engulfs the coast and can travel deep inland. Darkling beetles strategically position themselves on sand dunes, propping their bodies up and dropping their heads down, to drink the condensing water that collects along their shells. Snakes and lizards lick the drops from their own scales while ants drink the water that has collected on and around plants. All have adapted to take advantage of this precious source of moisture.

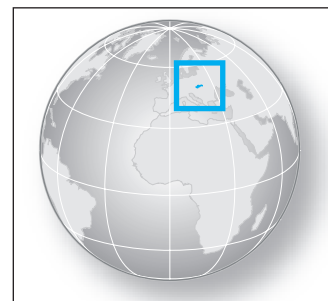
While the Skeleton Coast might have some ingenious wildlife that has successfully adapted to its treachery, few men have yet conquered its dunes. European explorers arrived in the 15th century, but hurriedly departed. More recently, prospectors and mining companies have, after finding little success, abandoned searches for diamonds in the area. Their deserted facilities, the shipwrecks along the coast, and the skeletons of men and animals throughout, help to give this barren, unforgiving place its name.

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## Slovakia

**Map Page** 1133 **Area** 18,859 square mi (48,845 square km) **Population** 5,430,033 **Capital** Bratislava **Highest Point** 8,682 ft (2,655 m) **Lowest Point** 308 ft (94 m) **GDP per capita** \$12,200 **Primary Natural Resources** brown coal, lignite, iron ore.



THE SLOVAK REPUBLIC or Slovakia is one of Europe's landlocked countries. Most of the country is rugged and mountainous, although the Tatra Mountains in the north are interspersed with many scenic lakes and valleys. The CZECH REPUBLIC and POLAND border the country to the north, with AUSTRIA to the west, HUNGARY to the south and the UKRAINE to the east.

The topography of Slovakia is dominated by the western Carpathian Mountains, a system of three east-west-trending ranges (Outer, Central, and Inner) that are separated by valleys and intermontane basins. There are also two large lowland areas, the Little Alfold in the southwest and the Eastern Slovakian Lowland in the east that make up the Slovakian portion of the Inner Carpathian Depressions region. The Central range across the middle of Slovakia includes the country's highest mountains, the High Tatra Mountains, and the Low Tatra Mountains to the south, with elevations of about 6,500 feet (1,980 m). Farther to the south still, the Inner range extends into Hungary and contains the economically important Slovak Ore Mountains. The Little Alfold in the southwest is a fertile plain whose soil is drained by the Danube River and its tributaries, notably the Váh.

Slovakia's easterly position gives it a more continental climate than that of the Czech Republic to the west. It also has a much more mountainous terrain that lends itself to greater variation in climate and weather.



Annual precipitation ranges from 22 in (57 cm) in the Danube plains to more than 43 in (110 cm) in windward mountain valleys. The higher peaks maintain snow cover into the summer months. Despite being landlocked, there is adequate access to the sea. Both Bratislava, the capital, and Komárno are major Danubian ports.

The Slovak leader Milan Rastislav Štefánik joined the Czech leaders Thomáš Masaryk and Eduard Beneš in the creation of Czechoslovakia after World War I. However, in the postwar years, the Slovaks found themselves politically subordinate to the Czechs and benefited less from the economic prosperity of the interwar period. The Munich Agreement in 1938 sealed the fate of Czechoslovakia, as the Nazis dismembered the Czech regions and established a Slovakian puppet state by 1939. In 1948, after liberation from Nazi rule, Czechoslovakia fell under communist rule. In 1968, Slovaks joined Czechs in the Prague Spring, which called for reforms, only to be crushed by the Soviet Union. The Velvet Revolution in 1989, however, led Slovaks to assert themselves once again. The transition from a command economy directed by Moscow to a free market economy was more difficult for Slovaks than for the Czechs. Slovaks also wanted a greater say in foreign policy and other political issues.

By 1993, irreconcilable differences led to the separation of Slovakia as an independent country. Mečiar became the prime minister of the new Slovak state. His authoritarian style of leadership caused some to doubt the course of a democratic Slovakia. Since independence, there have been friendly relations between the Czech Republic and Slovakia. Slovakia has joined the North Atlantic Treaty Organization and the European Union.

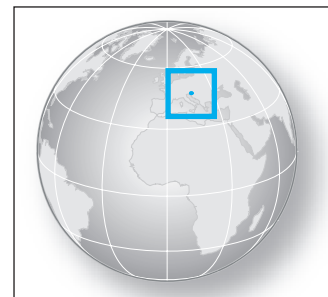
Slovaks make up the majority of the population in Slovakia. There is a significant Hungarian minority. In the postindependence period, there have been conflicts over recognizing the cultural rights of Hungarians living in Slovakia.

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## Slovenia

**Map Page** 1133 **Area** 7,906 square mi (20,273 square km) **Population** 1,935,677 **Capital** Ljubljana **Highest Point** 9,396 ft (2,864 m) **Lowest Point** 0 m **GDP per capita** \$19,200 **Primary Natural Resources** lignite coal, lead, zinc, mercury, uranium.



SLOVENIA IS LOCATED in Central Europe on the ADRIATIC SEA between AUSTRIA and CROATIA. The country's transitional area lies between the ALPS, the Dinaric area, the PANNONIAN PLAIN, and the Adriatic Sea. Because Slovenia is just half the size of SWITZERLAND, it is possible to ski in the morning, go wine tasting in the afternoon, and relax by the Adriatic in the evening.

The Alpine mountains, hills, and plains in northern Slovenia comprise two-fifths of the country. The mountains contain most of the country's limestone. Four-fifths of the land is covered by dense forest, primarily beech. Southeast of the mountains, the Alpine hills are primarily composed of dolomite and limestone. Isolated farmhouses and small villages comprise the population, which is declining. The western hills also contain a region known for its lace-making, abandoned mercury mines, and the medieval town of Škofja Loka (12,340 people). The country's capital, Ljubljana (267,008), and several other urban centers are located in the Alpine plains region.

The Dinaric plateaus and valleys run from the northwest to the southeast part of the country, and comprise the majority of southern Slovenia. Limestone and dolomite make up almost all of the Dinaric area and forest covers nearly three-quarters of the plateaus. Without much surface water, this region is prone to drought and forest fires, and the few villages in the region are decreasing in population. Only about two-fifths of the valleys of the Dinaric area are covered by forest, with several cities and towns in the east. In the west, the land is prone to flooding. Attempts to dam the intermittent Cerknica Lake have caused sinkholes to appear. Belowground, a fantasy world of over 7,000 caves rules this region, which is home to the Škocjan Caves, famous for the largest underground canyon in the world at 1.6 mi (2.5 km) long and 492 ft (150 m) high.

The Pannonian hills and plains comprise one-fifth of the eastern part of Slovenia. Forest makes up less

than a third of the region, creating a place for orchards and vineyards. The plains separate the hills from three of Slovenia's rivers: the Mura, Drava, and Krka. The city of Maribor (103,961), second only to Ljubljana in population, is located on the Drava plain. Smaller cities and the Krška nuclear power plant are also in this region. The forest is least prevalent on the Pannonian plains.

Mediterranean hills and plateaus make up the southwest part of the country, which includes only 10 percent of the country's land. Almost completely limestone, the Mediterranean Kras region is where the science of karstology began, and many Slovene words now make up the international language of karst studies. Slovenia's largest port town, Koper (24,704), is located here, along with several other tourist and fishing towns.

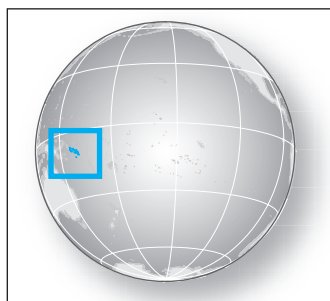
In spite of its small size, Slovenia serves as a major European transit route, beginning with its port to the world on the Adriatic Sea. It connects ITALY, Austria, HUNGARY, and Croatia via railways and roads.

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## Solomon Islands

**Map Page** 1128 **Area** 10,985 square mi (28,450 square km) **Population** 509,190 **Capital** Honiara **Highest Point** 8,028 ft (2,447 m) **Lowest Point** 0 m **GDP per capita** \$2600 **Primary Natural Resources** fish, forest products, gold, bauxite.



THE SOLOMON ISLANDS form an archipelago lying east of PAPUA NEW GUINEA, between the Solomon Sea and the South PACIFIC OCEAN. The country is composed of 992 islands and atolls, approximately one-third of which are inhabited. The principal islands of the chain

are Choiseul, New Georgia, Malaita, Santa Isabel, Makira, and Guadalcanal, where the capital Honiara is located. These larger islands feature rugged mountainous terrain covered with dense tropical rainforests.

Several of the islands show evidence of human occupation since 6500 B.C.E. Natural vegetation, marine life, and subsistence agriculture in the coastal areas have supported a sparse population since 4000 B.C.E., and westward migration by Polynesians dates from 1600 C.E. Spanish explorers began visiting the archipelago in the late 16th century. Western penetration was limited by the intense hostility of native inhabitants, as well as by the almost impenetrable jungle terrain.

Nonetheless, during the mid-19th century the Solomon Islands were a source of laborers for European colonies in Oceania and AUSTRALIA. Through a process known as "blackbirding," male youths were kidnapped and taken abroad under long-term labor contracts to work under harsh conditions in mines and on commercial plantations. The practice was halted around the time that GERMANY and Britain advanced claims to the islands of the archipelago in the 1890s. Germany's possessions in the northern Solomons, except the large island of Bougainville, were traded to Britain, and by 1900 most of the contemporary Solomon Islands formed a British protectorate.

During World War I, Bougainville and other islands remaining under German control were occupied by Allied troops, and afterward AUSTRALIA administered the Solomons. During World War II, JAPAN occupied most of the islands, and American forces fought to eject them, producing some of the Pacific War's most intense fighting. Australia and Britain shared postwar responsibility for the islands, with some of Australia's charges becoming independent in 1975 as part of Papua New Guinea. Britain also introduced self-government, and the British Solomons gained full independence in 1978.

With consistent year-round temperatures and tropical rainfall, the Solomon Islands feature tremendous biodiversity. Over 4,500 plant species have been identified, as well as a wide variety of insects, fish, mammals, and birds. Extensive mangrove swamps support specialized marine and bird life.

Although mountainous areas make up over 85 percent of the country's land area, a thriving timber industry aimed at European, American, and Australasian export markets has deforested some 10 percent of the country. Soil erosion, water pollution, and damage to the islands' coral reefs have become major environmental problems. Mining activities on certain islands

also contribute to soil erosion and create waste disposal problems.

Melanesians make up over 90 percent of the population, with small numbers of Polynesians, Chinese, and Eurasians composing the remainder of the Islands' full-time residents. Active missionary efforts dating from the mid-19th century have resulted in widespread acceptance of Christianity.

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## Somalia

**Map Page** 1114 **Area** 246,333 square mi (638,000 square km) **Population** 8,025,190 **Capital** Mogadishu **Highest Point** 7,927 ft (2,416 m) **Lowest Point** 0 m **GDP per capita** \$550 **Primary Natural Resources** banana, sugarcane, cotton, corn, sorghum.



SOMALIA OCCUPIES a strategic location along Africa's northeast coast at the southern approaches to BAB EL MANDEB and the route through RED SEA to the Suez Canal. The land is part of the famous HORN OF AFRICA and borders the Gulf of Aden and the INDIAN OCEAN, and lies to the east of ETHIOPIA. It is bounded by DJIBOUTI in the northwest, by Ethiopia in the west, by KENYA in the southwest, and by the Indian Ocean on the south and east.

Physically, the outline of the borders is somewhat similar to the number seven as the land raps around Ethiopia to the west. Most of the landscape suffers from arid, semidesert conditions making it relatively unproductive for any type of sustainable agriculture. Most of the coastal area is a narrow strip of barren lowlands that rise abruptly to an interior plateau,

which is generally 3,000 ft (910 m) high and stretches toward the northern and western highlands. There is a scrub-covered, semiarid, and generally drab maritime plain (the Guban) lying across the northern part of the country. Paralleling the Gulf of Aden coast, this plain is characterized by a hot and humid climate, low rainfall, and extremely sparse vegetation.

Moving away from the Gulf of Aden, the plain rises to the rugged mountain ranges that extend from the northwestern border with Ethiopia eastward to the tip of the Horn. Along this range occur the highest elevations in the country, including Mount Surud Cad, reaching an elevation of 7,897 feet (2,407 m) as well as precipitous north-facing cliffs that are part of very distinctive dissected highlands. The mountains give way in the south to the cooler and drier Hawd Plateau, while in the extreme south you find flat plains. The two major rivers, the Jubba and the Shabeelle, both of which rise in Ethiopia, flow southward across the country toward the Indian Ocean.

The climate is tropical and subtropical, with mean daily maximum temperatures often as high as 107 degrees F (42 degrees C) for days on end. Rainfall is scarce, but usually higher in the south and northwest with variations from 4 to 24 in (10 to 61 cm) over the country as a whole. In addition to Mogadishu, the other important cities are Hargeisa, Berbera (the main northern port), and Kismayo (the principal port of the south).

Somalia has not had a central government since the 1990s, especially after the overthrow of President Siad Barre in 1991. The country then entered a period of chaos because of intense fighting between rival warlords over control of Mogadishu. The country continues to be dominated by warlords responsible for small territories who are supported by heavily armed militias under their control.

Somalia became independent on July 1, 1960. It is the only true nation-state in Africa, because all Somalis are part of a Hamitic group on the basis of a common language, nomadic lifestyle, and Islamic religious heritage. However, the Hamitic group is broken into clans, which act as a unifying or dividing force.

By 1990, numerous clan-based armed resistance movements were attacking government troops. In 1991, Barre fled Mogadishu, which was seized by resistance forces of the United Somali Congress (USC). By the end of the year, the USC itself had split into two warring factions. Meanwhile in the north, the Somali National Movement (SNM) has declare the area under its control as a sovereign state namely Somaliland.

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## Sonoran Desert

THE SONORAN DESERT, an arid region of western North America, covers an area of 120,000 square mi (311,000 square km) in southwestern ARIZONA and southeastern CALIFORNIA, most of Baja California, and the western half of the state of Sonora, MEXICO.

It is one of the largest and hottest deserts in North America and has two primary subdivisions, the Colorado and Yuma deserts. A bimodal rainfall pattern produces a high biological diversity. The Colorado Desert, forming the western part of the Sonoran Desert, is closer to the source of Pacific storms and is noted for spectacular spring flowering of ephemerals when there is winter-spring rainfall. Pacific winter storms nourish many West Coast annuals (poppies and lupines), and summer monsoons host both annuals and woody plants originating from the south. Trees are usually well developed on the desert ranges and slopes; abundant on well-drained soils are little-leaf palo-verdes, desert ironwoods, catclaw, and saguaro. The understory consists of three to five layers of smaller woody shrubs. Tall cholla and saguaro cacti occur in a multitude of species, and the endangered acuña pineapple cactus is also present. Alluvial lowlands host communities of desert saltbush, wolfberry, and bursage. Creosote and bursage plant communities are common on coarser soils. Modern irrigation has created fertile agricultural areas, including the Coachella and Imperial valleys of California.

More than 2,500 species of flora support a wide variety of fauna, including the endangered Sonoran pronghorn, desert bighorn sheep (especially in the Maricopa Mountains area), and other mammalian species such as mule deer, javelina, mountain lion, gray fox, and bobcat. More than 200 species of birds are found, including numerous raptors and owls, particularly elf and western screech owls. A diverse array of

reptiles and amphibians, including the Sonoran desert tortoise and the red-backed whiptail, are also supported.

The region contains numerous significant archaeological and historic sites, including petroglyphs (rock art), lithic quarries, and permanent habitation sites, particularly along the bajadas of the Table Top Mountains. Vekol Wash was an important prehistoric travel and trade corridor between the Hohokam and tribes located in what is now Mexico. Villages were occupied by the ancestors of today's O'odham, Quechan, Cocopah, Maricopa, and other tribes. Among the historic trails are the Juan Bautista de Anza National Historic Trail, the Mormon Battalion Trail, and the Butterfield Overland Stage Route. The Sonoran Desert National Monument was designated by President Bill Clinton in January 2001. The saguaro cactus forests within the monument are regarded as a national treasure, rivaling those within the Saguaro National Park.

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## South Africa

**Map Page** 1116 **Area** 470,886 square mi (1,219,912 square km) **Capital** Pretoria **Population** 44,800,000 **Highest Point** 11,181 ft (3,408 m) **Lowest Point** 0 m **GDP per capita** \$10,000 **Primary Natural Resources** gold, chromium, diamonds, platinum.



OFFICIALLY called the Republic of South Africa, the country is a semiarid subtropical state located on the southernmost tip of Africa. To its north are BOTSWANA, MOZAMBIQUE, and NAMIBIA. To the northeast are SWAZILAND and ZIMBABWE. The ATLANTIC and INDIAN oceans meet at the Cape of Good Hope. LESOTHO, an inde-



pendent country with an area of 11,717 square mi (30,355 square km), is embedded within the northeastern section of South Africa.

The country is one of the most geographically varied countries of the African continent, comprising territory that ranges from the rolling, fertile plains of the highveld to the wide-open savanna of the Eastern Transvaal to the KALAHARI DESERT and the peaks of the DRAKENSBERG MOUNTAINS.

In addition, nearly all of South Africa's 472,000 square mi (1.2 million square km) lies below the TROPIC OF CAPRICORN. There are three primary geographic regions: an expansive central plateau, a nearly continuous escarpment of mountain ranges that ring the plateau on the west, south, and east, and a narrow strip of low-lying land along the coast. Most of the central plateau (and most of the country) consists of high, rolling grasslands known as highveld. The highest points of the mountainous escarpment are found in the stunning Drakensberg ("dragon's back") Mountains, where the peaks exceed 10,000 ft (3,050 m) in height.

In the northwest, South Africa's Kalahari Gemsbok National Park, one of the continent's largest game reserves, extends into the red sands and scrub grasslands of the great Kalahari Desert. In contrast, the highveld plateau in the northeast descends to the Bushveld and Limpopo River basins. The Bushveld comprises South Africa's equivalent of the savanna in an area known as the Eastern Transvaal. This marvelous grassland is rich in history and in the diversity of its game such as that found at the world-renowned Kruger National Park.

South Africa has a temperate subtropical climate that varies considerably across its various regions and environments. Temperatures typically remain comfortable throughout the year. Mean annual rainfall varies from less than 8 in (20 cm) in the arid northwest to more than 40 in (100 cm) along the KwaZulu/Natal coast in the southeast. The more fertile agricultural region occupies the narrow coastal plain in the west, south, and east.

The Orange and the Limpopo are the country's principal rivers. Interestingly, South Africa has three capitals, with Cape Town serving as the legislative capital, Pretoria as the administrative capital, and Bloemfontein as the judicial capital, while Johannesburg is the largest city. In addition to the diverse landscape, nothing stands out more about South Africa than its incredible mineral wealth. The country's gold and diamond mines have long been symbols of its wealth and influence on world markets.



*Cape Town, South Africa, is located on the coast where the Indian and Atlantic oceans meet at the southern tip of Africa.*

Interne conflict over land rights and colonial authority prevailed among indigenous South Africans and European colonists throughout the 19th century. In 1910, the British Parliament created the Union of South Africa and racial discrimination of indigenous South Africans was formalized. In 1913, for example, the Land Act organized approximately 13 percent of South Africa's total land area into homelands or Bantustans for indigenous South Africans.

After obtaining power in 1948, the predominantly Afrikaner Nationalist Party instituted a rigid system of racial segregation called apartheid that separated the country's ethnic racial groups in various sectors of society. Under the apartheid system, South Africans were classified by racial groups with the Population Registration Act, forced to live in race-specific areas under the Groups Area Act, and dissuaded from interethnic relationships. But black South Africans did not submit to apartheid supinely. They opposed segregation and racism using many political forms and strategies; their most notable organizations were the African National Congress (ANC), the Pan Africanist Congress (PAC), and the Inkatha Freedom Party (IFP). Though their strategies varied, these organizations vehemently opposed the apartheid system. After the Union of South Africa left the English Commonwealth in 1961, repression of antiapartheid activists and activities increased. From 1961 to the 1980s, all South Africans lived in a perpetual state of emergency that allowed the National Party to arrest and imprison Nelson Mandela, the famous ANC leader, and arrest and ban countless others.

Political parties were also outlawed and opposition to the apartheid regime was brutally crushed.

Suffering from the debilitating consequences of international isolation, Prime Minister F.W. De Klerk began instituting reforms in 1989. The prohibition of political parties was lifted, Mandela was released from prison, and over the next several years, through a series of political referendums, maneuverings, and compromises, the apartheid system was dismantled. The culmination of these reforms was the first ever-democratic general election in 1994, in which the African National Congress received over 62 percent of the general vote and Mandela was elected president of South Africa.

Not only is it healing its historical apartheid wounds, the country is also striving to cope with the AIDS epidemic. Among the nations of the world, South Africa has the largest population of people infected with HIV/AIDS. Experts estimate that in 2001, five million South Africans lived with HIV/AIDS and approximately 360,000 died from the virus.

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## South Carolina

**KNOWN AS THE** Palmetto State, South Carolina was named for Kings Charles I and Charles II of England. This small state, which was one of the 13 original colonies, covers an area that extends from the ATLANTIC OCEAN to the APPALACHIAN MOUNTAINS. South Carolina is bounded on the north by NORTH CAROLINA, on the east and southeast by the Atlantic Ocean, and on the west and southwest by GEORGIA. The Savannah River, shared by South Carolina and Georgia, makes up most of the western boundary of the state. The total area of South Carolina is 32,007 square mi (82,897 square km), and the state ranks 40th in size among the 50 states. It ranks 26th in population (4,107,183 people).

South Carolina's largest cities are Columbia (the capital), Charleston, North Charleston, Greenville, Rock Hill, Mount Pleasant, Spartanburg, Sumter, Hilton Head, and Florence.

Water covers 1,896 square mi (4,911 square km) of South Carolina's total area. South Carolina's major rivers are the Pee Dee, the Santee, and the Savannah. While the state has no large natural lakes, a number of lakes have been created by dams. The largest of these lakes are Lake Greenwood, Lake Marion, Lake Moultrie, and Hartwell/Thurmond Lake, which is shared with Georgia. The highest elevation of 3,560 ft (1,085 m) in South Carolina is Mount Sassafras, and the lowest elevation is where the land runs into the Atlantic Ocean (0 m).

Most of South Carolina enjoys a subtropical climate. In the Blue Ridge section, however, the climate is humid continental. Temperatures generally range from around 50 degrees F (10 degrees C) in the winter to around 80 degrees F (27 degrees C) in the summer. South Carolina experiences an annual rainfall of 45 in (114 cm). While rain falls throughout the year, most of the state rarely sees snow. The coastal area experiences occasional hurricanes such as Hurricane Hugo, which devastated the area in September 1989. The rest of the state is subject to periodic tornadoes.

South Carolina's geography encompasses three distinct regions: the Atlantic Coastal Plain, which covers approximately two-thirds of the state, extending from the coast of the Atlantic Ocean for 70 mi (113 km) and containing highly fertile soils; the Piedmont Plateau, with elevations ranging from 400 to over 1,000 ft (122 to 305 m) above sea level; and the Blue Ridge Region, which contains South Carolina's mountains that rarely exceed 3,000 ft (914 m) above sea level. A flat area within the Atlantic Coastal Plain that extends 70 mi (113 km) inland from the coast is called the Outer Coastal Plain. This area is filled with rivers and swamps. The state's most fertile area is located in the rolling hills of the Inner Coastal Plain.

The Fall Line is located in the area where the rivers of South Carolina's upland descend into the region that South Carolinians call the lowlands. The Sea Islands of South Carolina are connected to the mainland by a number of salt marshes, lagoons, and sounds, and soils in this area tend to be light and sandy with foundations of clay and sand.

The Pine Barrens, which are found in South Carolina's midlands, are home to numerous species of wildlife. Sand hills make up the westernmost edge of the Atlantic Coastal Plain. The Piedmont, also known

as the uplands, is made up of granite, slate, and gneiss. Hard rocks abound as the Piedmont gives way to the Blue Ridge Mountains. Within the Piedmont, elevations range from 400 to 1,200 ft (120 to 365 m) above sea level.

Dominated by agriculture until the beginning of the 21st century, South Carolina's economy is now chiefly shaped by commercial, financial, professional, and governmental industries such as the Savannah River Project, located near Aiken, South Carolina, and nearby Augusta, Georgia. Agriculture remains important to the state's economy, and South Carolina ranks third in the UNITED STATES in the production of peaches and fourth in the country in tobacco production. Other farm products include soybeans, vegetables, corn, hay, watermelons, and peanuts. The state also produces chicken, turkey, and cattle. A tea plantation located on Wadmalaw Island is the only commercial tea plant in the United States. The asbestos, wood pulp, steel products, chemicals, machinery, and apparel industries located in Charleston are essential to the economy of the state. Textiles are produced throughout much of the state.

The state flower of South Carolina is the yellow jasmine, the state tree is the palmetto, and the state bird is the Carolina wren. Approximately 60 percent of South Carolina is forested, most notably by several types of pine that include the longleaf, short leaf, slash, loblolly, and Virginia varieties. Oak, sweet gum, hickory, and magnolia are found in drained areas, while palmetto, cypress, tupelo, tulip trees, and sweet gum are located in South Carolina's wetlands. Wildflowers include azalea, gentian, mountain laurel, and violets. South Carolina's wild animals include white-tailed deer, opossum, rabbit, and raccoon. Several varieties of migratory birds, including water fowl, ducks, and geese, are frequently seen along South Carolina's coast. Birds found throughout the state include the catbird, mockingbird, oriole, and the Carolina wren. South Carolina is the only gold-producing state east of the Mississippi River. Other minerals found within the state include vermiculite, sand, kaolin, gravel, stone, peat, mica, and gemstones.

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## South China Sea

THE SOUTH CHINA Sea covers an area of 1.35 million square mi (3.5 million square km) bordered by the People's Republic of CHINA, the Republic of China (TAIWAN), the PHILIPPINES, MALAYSIA, BRUNEI, INDONESIA, SINGAPORE, THAILAND, CAMBODIA, and VIETNAM. The South China Sea is a marginal sea, which means that it is part of the PACIFIC OCEAN but at the same time separated from the ocean by an archipelago.

The archipelagos are placed together into four groups; the Spratly Islands, which are the largest group according to landmass, followed by the Macclesfield Islands, the Paracel Islands, and finally the Pratas Islands. All four of these groups are thought to be rich in oil and natural gas reserves, which naturally leave them to be contested by the surrounding countries. A healthy oil estimate in the Spratly Islands can be anywhere from 105 billion barrels to 213 billion barrels. The proven oil reserves, however, are 7 billion barrels. Production per day is 2.5 million barrels of oil.

It is estimated that the natural gas reserves in the South China Sea may be the most abundant hydrocarbon resources in the region. The U.S. Geological Survey indicates that 60 to 70 percent of the hydrocarbon resources in the region are gas. Some optimistic studies suggest that 70 percent of the hydrocarbons believed to be located in the Spratly Islands will be gas. Natural gas usage by developing Asian countries is of utmost importance, as it is believed that usage will increase by 4.5 percent annually through 2025. Demand of natural gas will triple if this estimate is maintained.

The Spratly Islands as well as the Paracel Islands are heavily contested by all of the South China Sea's bordering countries. For example, the People's Republic of China claims all of the four main subarchipelago islands as part of its Hainan Province. Vietnam claims all of the islands in its Khanh Hoa Province and occupies one of those islands. Taiwan claims all of the Spratly Islands and occupies one (Taiping). Malaysia occupies three islands. The Philippines claim most of the Spratly Islands and occupy eight. Brunei and Indonesia claim not the islands but instead the entire South China Sea.

On a historical note, however, it is easy to understand the importance of the South China Sea in relation to the surrounding economies. For example during the Han Dynasty, the South China Sea was the starting point for the Silk Road on the ocean. It started in the South China Sea moving on to INDIA and SRI LANKA. It crossed the northern end of the RED SEA and ended in



Rome, Italy. Today, it still maintains its economic importance as the world's second busiest international sea lane. Annually, it has half of the world's supertanker traffic passing through its waters.

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## South Dakota

SOUTH DAKOTA, IN THE American Midwest, is the 17th largest state at 77,121 square mi (199,742 square km), but is small in population (just 754,844 people ranking it as 46th largest in population). Accordingly, South Dakota is a very sparsely populated state, with just under 10 people per square mile.

The landscape of South Dakota varies from mainly rolling hills and plains in the east to drier and more rugged terrain in the west. In terms of both the PHYSICAL GEOGRAPHY and the CULTURAL GEOGRAPHY, South Dakotans use the Missouri River as the major divide for the state, referring to the West River and East River portions of the state. This colloquial division roughly corresponds with a western dry continental climate fitting the Great Plains and an eastern humid continental climate of an agricultural interior. South Dakota is bordered to the north by NORTH DAKOTA, to the south by NEBRASKA, to the west by MONTANA and WYOMING, and to the east by MINNESOTA and IOWA.

The western ruggedness of South Dakota is witnessed in fantastic form at the Badlands, a stunning region where intricately colored and shaped rock formations were created from erosion over the ages. Nearby the ruggedness reaches its apex at Mount Harney (7,242 ft or 2,207 m) in the Black Hills, a lushly forested area along the Wyoming border.

In addition to the forests that gave it the name Black Hills, the region features a number of interesting physical landscape features: sharp slopes such as Spearfish Canyon, erosional spires or pinnacles known as The Needles, and limestone caverns such as Wind Cave and Jewel Cave. Besides their scenic beauty, the Black Hills hold a rich history of gold mining, gam-

bling, grazing buffalo, and colorful figures such as Wild Bill Hickock and Calamity Jane in the town of Deadwood. While the Black Hills, featuring Mount Rushmore and the Badlands, do get many tourists, the urban focal point is Rapid City (population 59,607). Otherwise the region is mainly a mix of small towns, farms and ranches, and impoverished Indian reservations.

On the whole, South Dakota experiences a climate of seasonal extremes. Winter brings annually varying amounts of snow but intensely cold temperatures. For the months of December, January, and February temperatures below zero are not uncommon. Nighttime temperatures can reach -30 degrees F (-34 degrees C) and even daytime wind-chill factors may present health risks for those not properly dressed for the cold. After a typically brief and wet spring season, summers in South Dakota bring heat and sunshine. Usual summer days have high temperatures reaching 70 to 90 degrees F (21 to 32 degrees C), but several times each summer the heat will pass 100 degrees F (37 degrees C). South Dakota residents often cite the pleasant and dry falls as their favorite time of the year. Both winter and summer offer extreme storms. Winter blizzards often close highways and schools. Summer thunderstorms are spectacular and common, with some of these storms spawning tornadoes.

### POPULATION GEOGRAPHY

Although the rich physical geography of the western half of the state leaves eastern South Dakota with its modest hills and plains, a majority of the human activity takes place in the east. Most of the state's small population resides in the east, especially as urban nodes along the interstate highway system. The I-29 corridor features the state's largest city Sioux Falls (123,975) as well as Aberdeen (24,658), Watertown (20,237), Brookings (18,504) and Yankton (13,528). In fact, a majority of the state's population lives in this narrow corridor within 80 km (50 mi) of the state's eastern border.

Blessed with rich chernozem soils, the eastern half of the state features successful corporate and family farms. Agriculture is the largest segment of South Dakota's economy. The state typically leads the country in the production of oats and rye but also produces considerable yields of corn, wheat, and soybeans. The towns and cities of South Dakota, principally Sioux Falls, feature light manufacturing and increasing service and financial sector employment, bolstered by tourism.



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## South Georgia and South Sandwich Islands

SOUTH GEORGIA and the South Sandwich Islands are two island formations at the southern extremities of the ATLANTIC OCEAN, not far from the Antarctic Peninsula that juts out from ANTARCTICA, 1,000 mi (1,600 km) to the south. Mostly consisting of steep mountains and ice, they have never had an indigenous population, but are instead known for one of the most numerous and diverse bird populations on earth. The British have administered the islands since 1908, first as dependencies of the Falkland Islands about 800 mi (1,300 km) to the northwest, then as a separate territory dating from 1985. ARGENTINA continues to claim the islands, but has formally renounced intentions to regain the islands militarily.

South Georgia and the South Sandwich Islands are volcanic in origin, formed on the boundaries of two small tectonic plates, the Scotia and South Sandwich plates, as they rub against or are subducted beneath the much larger South American Plate. South Georgia consists of one main island, with smaller islands offshore (Willis, Bird, and Cooper), plus the more distant Shag Rocks, Black Rock, and Clerke Rocks. The South Sandwich Islands are a chain of 11 main islands (from north to south): Traversay, Protector Shoal, Zavodovski, Leskov, Visokoi, Candlemas, Vindication, Saunders, Montagu, Bristol, and the Thule Islands.

These islands form an arc, stretching about 240 mi (400 km), following the curve of the South Sandwich Trench, a deep trough in the Atlantic sea floor. The South Sandwich Islands are highly volcanic and geologically recent in origin: roughly 5 million years. Most of the islands consist of basalt and lava flow, with glaciers covering about 80 percent of each island. Together, South Georgia and the South Sandwich Islands form part of the Scotia Arc, which extends from the tip of South America to Antarctica (and also includes the South Shetland and South Orkney Islands, though these are not part of the British dependency).

The island of South Georgia is 105 mi (170 km) long, and about 25 mi (40 km) wide. Two mountain ranges form its spine, with 11 peaks exceeding 6,600 ft (2,000 m). The coastline of South Georgia is generally rough and mountainous, with plentiful large bays and inlets, mostly on the north coast, well suited for deep-water anchorages and whaling stations. Moraine on the floor of many of the bays, deposited by over 160 glaciers, creates a serious hazard for ships and has caused numerous wrecks. The interior is rugged and mostly covered in permanent ice and snow, with little vegetation. The South Sandwich Islands are difficult to approach by ship because of these extreme weather conditions.

### DISCOVERY

Claims for first discovery of the islands are clouded in uncertainty on account of the remoteness and inhospitality of the climate in this part of the world. Different theories of discovery are put forward by supporters of British or Argentine claims over the islands.

Several explorers are cited as having spotted South Georgia's icy mountaintops in the early 18th century, but the first confirmed sighting and landing is by Captain James Cook in 1775, who named it after his sovereign, King George III. Cook also visited the Sandwich Islands (and named them for the fourth Earl of Sandwich, first lord of the Admiralty), but the first landing was not until 1818, when seal hunters visited. Shortly after reports of the island's large seal population got back to Europe, sealing expeditions set out for the South Atlantic, the start of a big business that continued for two decades until the island's seal population was nearly wiped out.

Whaling stations were established by Scandinavians in the early 20th century, the largest at Grytviken, which was abandoned in the mid-1960s, but is now being redeveloped as a museum. Grytviken was also a starting point for many 20th-century expeditions to Antarctica, including the famous doomed journey of Sir Ernest Shackleton and the crew of the *Endurance*. A new base was developed in the 1950s at King Edward Point, which is currently the seat of British administration, meteorological observations, and regulation of natural and commercial wildlife.

The UNITED KINGDOM extended its exclusive fishing zone in 1993 from 12 nautical mi to 200 nautical mi around each island to preserve marine stocks. Economic activity is limited to fisheries, with potential for harvesting finfish and krill. Reindeer, introduced in the 21st century, live on South Georgia. Tourism is also a

recent new business, with increasing numbers of specialized cruise ships bringing tourists to view the islands' abundant wildlife: South Georgia is a vital breeding oasis for some of the greatest concentration of wildlife on the planet—at least half of the world's populations of southern fur seals, southern elephant seals, penguins, and albatrosses come here to breed each summer.

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## Southern African Development Community

IN 1980, NINE FRONTLINE southern African countries came together as the South African Development Coordination Conference (SADCC) to promote economic stability, increase interdependence, mitigate poverty, and battle the issue of apartheid in SOUTH AFRICA. In 1992, SADCC became the Southern African Development Community (SADC). By 1997, SADC had grown to 14 nations, including South Africa, where apartheid had been abolished. The geography of the SADC nations is varied, but the member nations share a host of problems that are due in part to underdevelopment and mismanagement of resources and to economic dependence on outside forces.

The Declaration and Treaty establishing the community was signed at the Summit of Heads of State or Government on August 17, 1992, in Windhoek, NAMIBIA. The 14 countries are: ANGOLA, BOTSWANA, Democratic Republic of CONGO, LESOTHO, MALAWI, MAURITIUS, MOZAMBIQUE, Namibia, SEYCHELLES, South Africa, SWAZILAND, TANZANIA, ZAMBIA, and ZIMBABWE.

The objectives of the community as stated in the treaty are to achieve development and economic growth; alleviate poverty; enhance the standard and quality of life of the peoples of southern Africa and support the socially disadvantaged through regional integration; evolve common political values, systems,

and institutions; promote and defend peace and security; promote self-sustaining development on the basis of collective self-reliance, and the inter-dependence of member states; achieve complementarity between national and regional strategies and programs; promote and maximize productive employment and utilization of resources of the region; achieve sustainable utilization of natural resources and effective protection of the environment; strengthen and consolidate the long-standing historical, social, and cultural affinities and links among the peoples of the region.

The SADC countries encompass an area roughly 2,874,747 square mi (7,445,560 square km), with a population of approximately 195,816,778 people. These countries are rich in natural resources, including coal, chromium, gold, diamonds, emeralds, copper, lithium, nickel, tin, phosphates, talc, manganese, plutonium, uranium, titanium, limestone, bauxite, radium, asbestos, clay, hydropower, natural gas, and forests. The potential for agriculture in the area is varied, including vegetables, fruits, grains, nuts, spices, rubber, quinine, palm oil, cotton, tobacco, coffee, tea, sugarcane, sisal, rice, sorghum, cassava, wood, livestock, and fishing. However, these resources are often vastly underdeveloped or mismanaged. A lack of potable water and severe water shortages pose major risks. The area also experiences wildlife piracy, coral reef destruction, soil erosion, land degradation, DESERTIFICATION, deforestation, and a myriad of other problems.

Resources within the SADC are constantly being drained by extreme poverty, high birth rates, low life expectancy, high infant mortality, moderate literacy rates, and high incidences of HIV/AIDS. In the poorer countries, such as Tanzania, which has a per capital income of only \$610, families eke out a living from subsistence farming. Floods, droughts, cyclones, and volcanoes further drain the resources of the SADC countries. In spite of the vast problems in the region, the SADC and outside investors have fostered growth in a number of industries, including mining, transportation equipment, textiles, apparel, machinery, steel, chemicals, beverages, glass, cement, lumber, furniture, handcrafts, fishing, and tourism.

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# Spain

**Map Page** 1131 **Area** 194,897 square mi (504,782 square km) **Population** 42,717,064 **Capital** Madrid **Highest Point** 12,191 ft (3,718 m) **Lowest Point** 0 m **GDP per capita** \$20,870 **Primary Natural Resources** minerals, coal, lignite, iron ore, uranium.



SPAIN IS A COUNTRY located in southwestern Europe, occupying with PORTUGAL the Iberian Peninsula. Spain also borders FRANCE and ANDORRA, and is bounded by the ATLANTIC OCEAN and by the MEDITERRANEAN SEA. As a parliamentary monarchy since 1978, the state is headed by the king, but most executive powers fall to an elected president of the government who designates the council of ministers and directs the country. The parliament includes two houses, the Chamber of Deputies and the Senate, whose members are elected by the people. Spain is the fourth-largest country in Europe after RUSSIA, UKRAINE, and FRANCE. MADRID is the capital and largest city.

Spain is a highly decentralized state. The country is divided in 50 provinces, which are a part of 17 larger autonomous communities, including the Balearic Islands in the Mediterranean Sea and the CANARY ISLANDS in the Atlantic. Ceuta and Melilla, two coastal exclaves within MOROCCO, have enjoyed special status as autonomous cities since 1994. The communities have their own regional parliament and government, granting them some independence from the central government in Madrid.

Spain also holds a few small uninhabited possessions off the coast of Africa, the Peñón de Vélez, the Alhucemas, and the Chafarinas Islands. The UNITED KINGDOM retains a 300-year rule over the colony of GIBRALTAR, a rocky promontory holding high strategic value as the gateway between the Mediterranean and the Atlantic.

Despite strong unifying traits, in Spain an eventful historical process blended with the natural conditions to produce a country made of many cultural layers and displaying striking geographical diversity. The territory of present-day Spain has been inhabited for more than 100,000 years, during the course of which the area was settled or visited by many groups, including the Phoenicians, Celts, Greeks, and Carthaginians. Around 200 B.C.E., the Romans extended their empire to the re-

gion, extracting minerals and leaving infrastructures such as roads, aqueducts, and amphitheaters. The name *España* comes from the designation of the area as Hispania while a province of Rome.

Moors, north African Muslims, invaded in 711 C.E. and quickly conquered most of the peninsula, with the exception of a narrow area along the mountainous north, the Asturias. Christians began pushing the Moors southward almost immediately, and the process of Reconquista (reconquest) would last for 800 years. The marriage of Ferdinand of Aragon to Queen Isabella of Castile started the unification of the Iberian kingdoms to form Spain, which was concluded in 1512 with the conquest of Navarra, to the northeast.

The year 1492 marked the beginning of a great age for Spain, with the seizure of Granada, the last Islamic kingdom on the peninsula, and Columbus's maiden voyage to America under Spanish sponsorship. With the exploration and conquest of the New World, Spain built a mighty and profitable world empire in the 16th and 17th centuries and dominated Europe. In the 16th century, Seville was the largest Spanish city, serving as a base for expeditions to the colonies overseas.

However, the difficulty in controlling such a vast empire, economic hardships, and involvement in wars led to the decline of Spanish power in the 1700s, and especially in the 1800s, when most colonies declared their independence during Napoleon's occupation of the peninsula. Despite the long period of influx of wealth from overseas possessions, until the mid-1900s most Spaniards were poor farmers and the country went largely undeveloped. During the late 1930s, a bloody civil war had a destructive effect and put Spain under General Francisco Franco's dictatorship until 1975, when his death opened up a new opportunity for democracy. Franco's heavily centralized power tried to suppress regionalism and all separatist tendencies were repressed.

Starting in the 1950s, rapid economic development changed Spain into an industrial nation. The country joined the EUROPEAN UNION in 1986 and adopted the European single currency in 2002, the euro.

## LAND AND RESOURCES

Being a part of Europe but standing only 8 mi (13 km) north of Africa, the bulky mass of the Iberian Peninsula sits in a bioclimatic transition zone, functioning in many ways as a small continent. Therefore, Spain is a land of very diverse landscapes, having contrasting topography and significant climatic differences. The PYRENEES have isolated the peninsula from France and





*Despite many changes, a traditional Spain of windmills, siestas, and an unhurried life endures in the European country.*

Central Europe for a long time, and the area concentrates a large share of the biodiversity found in the European continent. Biomes range from conifer forests to wetlands and desert areas, some protected under a network of 13 national parks.

The climate ranges from temperate Atlantic in the north to markedly Mediterranean in the south. Northern areas enjoy cool summers, mild winters, and abundant rainfall year-round, upward of 50 in (150 cm). The interior has hot, dry summers and cold winters, with snow blanketing the higher elevations. July temperatures are lower along southern and eastern coasts; winter is more moderate, with the area around Almeria receiving less than 10 in (25 cm) of rain a year.

Spain is a mountainous country, being second in Europe in average elevation (2,130 ft or 650 m). Central Spain can be described as a large, high platform,

called Meseta, sloping gently to the west, surrounded by several mountain ranges that prevent ocean moisture to penetrate inland. Castile, the historical and geographical heart of Spain, spreads over most of this tableland. Much of the region is a semiarid expanse of open fields, punctuated by brown-colored towns overlooked by ancient castles sitting on top of hills.

The area suffers from a harsh climate and poor soils, used for growing cereals and as pastureland for farm animals, the *dehesas*. This eroded plateau is bisected by the Sierra de Gredos and Sierra the Guadarrama, which are part of the Central Range. The higher northern sub-meseta corresponds mostly to the mighty Duero river basin, while the southern extension is drained by the rivers Tagus and Guadiana and comprises the Extremadura. On this agricultural province, major irrigation projects have recently allowed for forestation and the introduction of more profitable crops.

To the north of the Meseta stands the Atlantic Spain, humid and green. The land rises rapidly from the indented Bay of Biscay to the limestone heights of the Cantabrian Range, which occupies most of Asturias. To the east stand the lower Basque mountains in the more industrialized Basque country. Galicia occupies the northwest corner along a rugged coast with fjordlike inlets called rias, used for seafood farming. The region remained isolated and undeveloped for a long time and was the origin of numerous immigrants to Spanish America. Grazing dairy cattle and growing corn are major agricultural activities, and fishing is important in coastal towns.

Rising to the northeast, the Pyrenees are special for their forests and magnificent views, descending to the vineyards of La Rioja and the Ebro river basin. This wide, terraced valley has maritime origin, being a former sea inlet now filled with sediments. Thanks to irrigation, it has been converted to intensive agriculture. Throughout the arid lower Aragon the settlements merge with the landscape, both displaying the same earth tones.

South of the Meseta and beyond the Sierra Morena spreads Andalusia, a region of white villages where cultivation of olive trees is a major agricultural activity. The valley of the river Guadalquivir, filled with sediments from the tertiary and quaternary Eras, is one of the most fertile regions of Spain, with rice being cultivated on the eastern reaches. Vineyards dominate the landscape around Jerez, from which the famous sherry is produced. Mineral extraction has remote origin in the region and includes copper, iron, and lead. Tower-



ing over the Moorish palaces of Alhambra in Granada, the Sierra Nevada boasts the highest elevation of the peninsula (11,408 ft or 3,478 m) and Europe's southernmost ski resort.

In Almeria, to the southeast, rows of greenhouses allow the semidesert region to be a major producer of fruits and vegetables. The Mediterranean region includes long and fertile coastal plains at times interrupted by hills that extend to the sea, forming rocky capes between sandy shores. Palm trees are abundant around Elche and rice is cultivated on some flat, wet areas. The population concentrates along the coast, and the economy relies heavily on the numerous tourist resorts of Costa del Sol and Costa Blanca, up to the rugged Costa Brava in Catalonia.

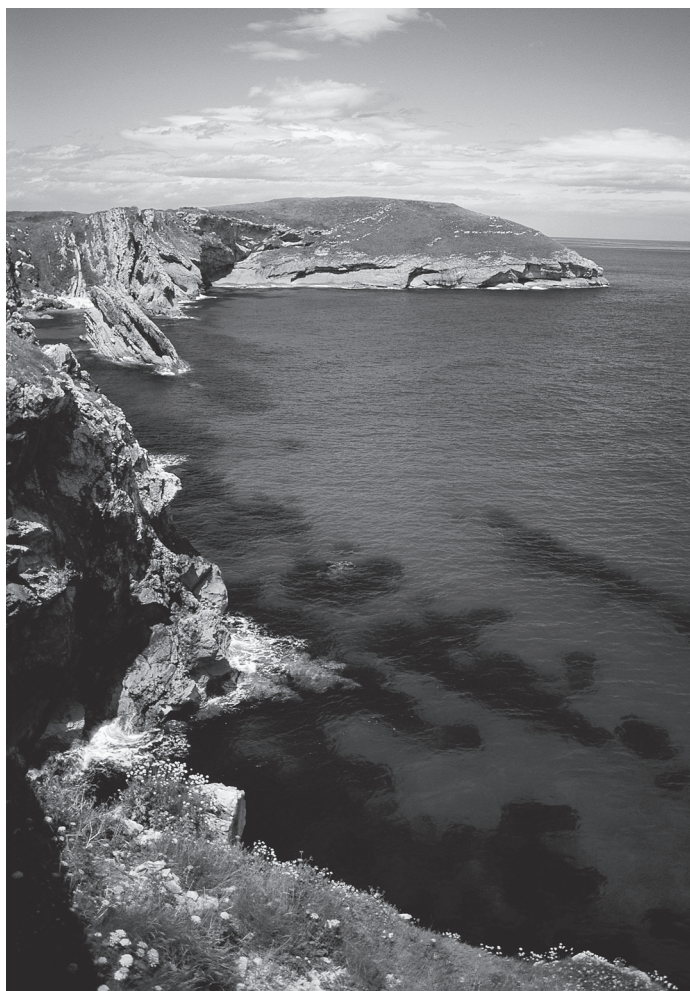
The Balearic Islands stretch a few hundred kilometers off Cabo de la Nao (Cape de la Nao). Because of its favorable climate, the limestone archipelago is an important holiday destination, especially the three main islands of Mallorca, Menorca, and Ibiza. In Mallorca, pine trees extend to the rocky coast, and the island produces citrus, olives, figs, and almonds.

Off the northwest coast of Africa, the Canary Islands have volcanic origin and are mostly dry and barren, with the exception of La Palma and some north-facing coasts. The main islands are Lanzarote, Fuerteventura, Gran Canaria, and Tenerife, the last dominated by the giant volcanic cone of the Teide peak, the highest elevation in Spain. Because of warm temperatures and almost absent of rain, the islands are popular among central European vacationers as winter beach resorts.

## ECONOMY AND SOCIETY

Because of a late and rapid industrialization, Spain has experienced dramatic economic changes and development in recent times. Since the 1950s the country has gone from depending on agriculture and fishing to being an industrial nation, at the same time modernizing farming practices. About 65 percent of workers are now employed in the service sector.

The territory has limited energy sources and scarce raw materials for the industry. Nevertheless, there is still significant mining activity, especially in the north, where the importance of coal has declined, and the country has small production of oil and natural gas. The main manufactured products are cars, iron and steel, cement, clothing and shoes, and machinery. Spain's major exports include motor vehicles, machinery, and foodstuffs. Bilbao is the principal center for production of iron and steel. Barcelona, the second



*Spain has 3,084 mi (4,964 km) of Mediterranean Sea and Atlantic Ocean coastline, most of it on the Mediterranean.*

largest city, is a major industrial area and main center of trade, thanks to its large harbor. Madrid leads in service industries.

Spain has an important fishing industry, supported by a large fleet. Vigo, in the northwest, is Europe's largest fishing port.

Although arable land makes up about one-third of Spain's surface, soils are mostly poor and rain is scarce. Permanent crops (olive trees, orchards, vineyards), which are adapted to Mediterranean conditions, occupy around 10 percent of the land and help overcome these limitations. Irrigated cropland has been increasing, supported by large projects that contemplate water diversion from northern rivers. Chief agricultural production includes wheat, corn, alfalfa, other vegetables, wine, fruits, olives and olive oil, pork, beef, and dairy products.

Tourism has boomed since the 1950s and become a mainstay of the economy; the country being one of the world's leading tourist destinations. Every spring and summer huge numbers of tourists flock to large resort cities built along the Mediterranean coast, overwhelming the local population. Benidorm, in the Costa Blanca, increases its winter population by 20-fold to more than 1 million in the summer months.

The population of Spain has been increasing steadily, with most Spaniards living in urban centers. Main agglomerations developed around Madrid, Barcelona, and in the industrial belt of the Basque country, but Valencia, Seville, and Zaragoza are also large cities, well distributed around the territory. Major cities are connected through a modern network of expressways, and increasingly through a high-speed train system.

Roman Catholicism is the main religion and was instrumental in keeping Spaniards together. Castilian Spanish is the official language nationwide, but official regional languages include Catalan, Galician, and Basque. Spain has a significant immigrant population, especially in the south and east. Main communities include Latin Americans and Moroccans, some of whom challenge the waters of the Strait of Gibraltar in small boats and come to Spain seeking jobs as farmhands.

Spaniards enjoy spending much of their leisure time outdoors. To celebrate the country's vitality 500 years after Columbus and the reconquest, in 1992 Spain organized the World Fair in Seville and the summer Olympic Games in Barcelona. Economic growth notwithstanding, a high unemployment rate has been a persistent problem in the last decade.

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## Spanish Empire

THE SPANISH EMPIRE designates the whole of territories that were conquered and ruled by SPAIN as a result of exploration and colonial expansion initiated in

the 15th century. This expansion turned Spain into the first transcontinental superpower during the 16th and 17th centuries and helped shape much of the modern world. Built on military might and naval ingenuity, and maintained by trade and the mining of gold and silver, this period is appropriately known as the Golden Age of Spain.

The Spanish imperial age had profound repercussions in Europe and especially in the conquered regions. The destruction of ancient civilizations, the decimation of indigenous populations, and the introduction of mass slavery rank among the worst consequences. However, the expansion also increased trade, spurred development, and allowed the transplanting of technologies and the adoption of new crops.

At its greatest extent, the empire included most of Central and South America, as well as important areas in North America, Africa, Asia, and in Oceania. In the Americas, Spanish possessions stretched from the present-day western UNITED STATES, through Mexico and Central America, and along the western shores of South America to the edge of Patagonia; they included the state of FLORIDA, the Caribbean islands, and what would become VENEZUELA, COLOMBIA, BOLIVIA, PARAGUAY, URUGUAY, and ARGENTINA. In Africa, in different periods, Spain held possessions on the coast of present-day EQUATORIAL GUINEA, including the island of Fernando Póo (now Bioko), and occupied territories in the WESTERN SAHARA (occupied by modern MOROCCO). In Asia, Spain ruled the PHILIPPINE Islands. In Oceania, Spain held the Mariana Islands and later the Caroline Islands.

It is true that in some areas, especially in the Americas, Spanish sovereignty was more official than factual, with large tracts of wild and sparsely populated land remaining unexplored until the 1800s. But despite the difficulty to control such a vast domain, Spain maintained much of the empire until the 19th century. Today only the North African exclaves of Ceuta and Melilla and the CANARY ISLANDS, off the African coast, remain under the Spanish flag.

### ORIGIN OF THE EMPIRE

The process leading to the formation of the Spanish empire is rooted in the Reconquista (reconquest), the Crusades undertaken in 722 C.E. by Christian kingdoms in the north of the Iberian Peninsula against the Muslims who had invaded from North Africa. It was the marriage of Isabella I of Castile and Ferdinand V of Aragón in 1469 and the resulting union of their separate Iberian kingdoms that marked the onset of Spain's

overseas empire. Several major reasons can explain the Spanish overseas expansion.

The will to spread Christianity farther was a legacy of the long period of reconquest, which strengthened convictions of ethnic superiority among the Spaniards. A sense of carrying out a higher mission could be kept alive and increase Spain's international influence. Finally, the need was felt to compete with the neighboring kingdom of PORTUGAL for new territory and for the chance at easier trade with the Far East. Portugal had gained some advantage by embracing maritime exploration from the start of the 15th century and by establishing strongholds in Atlantic islands and along the western coast of Africa, then practically unknown to Europeans. A sea route to the Far East was found when, in 1488, the Portuguese navigator Bartolomeu Dias sailed around the Cape of Good Hope, at the southern tip of Africa. Also, it was considered necessary to protect Spain's shipping activities and establish fortified positions for defense against Muslim raids. Those areas could also serve as outposts for export of African slaves and precious metals.

Following suit to this strategy, in 1479 Spain gained control of the Canary Islands, important as a source of fish and sugar, but especially for their strategic location. Close to the west African coast, the islands would become valuable as a resupply base for Atlantic crossings.

The year 1492 marks a definitive turning point for Spain and is a key date for the empire. In this year, the Reyes Católicos, Isabella and Ferdinand, concluded the Iberian reconquest by seizing the Moorish kingdom of Granada and sponsored the search of a westward way to reach Asia, led by Italian navigator Christopher Columbus. The enterprise had been offered and turned down by Portugal, which was more interested in pursuing the African route. At the time, it was thought that the circumference of the Earth was significantly smaller than it actually was, and that no relevant landmasses existed between Europe and Asia. Columbus assumed he had reached India when he inadvertently discovered the Americas, and so the Spanish called the area the Indies. Columbus landed on the island of Española (Hispaniola) and sighted CUBA and upon his return claimed for Spain the lands he explored.

Spain and Portugal benefited from strong support by the Catholic Church when their kings began taking the Christian crusades overseas. In other places, ISLAM was still advancing and threatening Christian Europe. The new conquests were confirmed by official papal decrees, with the pope mediating and reducing con-

flicts between the two nations by attributing more formal boundaries to claims of vaguely bounded territories. At Spain's request, in 1493 Pope Alexander VI officially certified the right of Spain to the newfound West Indies, helping to set the division of the unexplored world between the two countries. In 1494, Portugal and Spain signed the Treaty of Tordesillas that established the Line of Demarcation. Crossing over present-day Brazil at the approximate longitude of 48 degrees, this meridian line granted to Spain new land to the west and to Portugal the discoveries to the east. Hence, following the landing by Pedro Álvares Cabral at Porto Seguro in 1500, Portugal claimed Brazil.

### THE AMERICAS

Between 1493 and 1502, Columbus made three more voyages to the Americas, insisting that he had reached India, causing the indigenous peoples of the new continent to be called Indians, regardless of their different cultures. The Americas were indeed a new world for Europeans, filled with hostile environments and in some places inhabited by unfriendly natives, who were vulnerable to imported firearms and newly introduced diseases.

The impact of the colonization process was tremendous for both natives and newcomers, and some initial attempts at creating permanent settlements failed. Along with farm animals and fruit trees, Columbus also took around 1,500 colonists on his second voyage to Hispaniola, but within a decade only one-tenth of the original population of the island survived. The colony relied heavily on native labor, and the native Taínos died from overwork, battles, or disease. The friar Bartolomé de Las Casas would become notable by denouncing the constant abuses of Native Americans. Due to the natives' high mortality, in 1505 the first African slaves were brought to the Americas, inaugurating a grim commerce that would last four centuries and involve 10 million Africans.

Columbus was unsuccessful in his role as administrator and in 1500 lost his post as governor of the Indies. Still, intense immigration continued and by 1509 some 10,000 Spaniards lived on Hispaniola.

From the early 16th century, Spaniards also used the major Caribbean islands as a base for expeditions to mainland Central America and to explore the Golfo de la Nueva España (Gulf of Mexico). In the first half of the 16th century, the New World became a stage of intense expeditionary activity, with Spaniards launching multiple incursions by sail, horse, and foot into the unknown territories. These expeditions were



prepared and led by a legion of hardened men, each a blend of navigator, explorer, and warrior, called the *conquistadores* (conquerors). These men, some veteran of the Iberian reconquest, came enticed by promises of great wealth and glory and mythical places, such as the Seven Cities of Cibola or the Fountain of Youth. These prospects also attracted able Portuguese and Italian navigators to the service of the Spanish crown. The *conquistadores* advanced through Central and South America taking treasure and territory for Spain while evangelizing the natives, thus winning recognition from the king and approval from the Church.

From Hispaniola, Ponce de León settled PUERTO RICO in 1508 and Diego Velázquez conquered Cuba in 1511. In 1510 Vasco Núñez de Balboa founded the first colony on the mainland in Darién, in today's Panama. Three years later, his men crossed the Central American isthmus and became the first Europeans to see the Pacific Ocean. That same year, Ponce de León sailed northward, encountering the GULF STREAM and landing in Florida. In 1526, Lucas Vázquez de Ayllón started a colony in coastal Georgia. Hernando de Soto, and others further explored North America, and during 1540 to 1542, Francisco Coronado's party penetrated inland as far as the Great Plains and sighted the GRAND CANYON. Francisco de Ulloa explored the western coast of MEXICO and Juan Cabrillo sailed to CALIFORNIA, his men reaching as far north as OREGON.

In Central and South America the explorers came upon civilizations wealthier and more advanced than the Caribbean cultures, such as the Maya and Aztec peoples in Mexico and the Incas in PERU. Their technology enabled abundant crops and successful settlement of inhospitable places. The Aztec ruled an area that stretched from central Mexico to GUATEMALA, as an empire where city-states dominated smaller communities and ethnicities.

With aid from Amerindian allies and epidemics, in 1521 Hernán Cortés captured the capital of the Aztec Empire, Tenochtitlán, a sophisticated city of 200,000, and in its place erected MEXICO CITY. Cortés tried to claim the area for himself, but instead it would become part of the colony of New Spain. The conquest of the Yucatán and the Maya realm took longer and was less interesting for Spaniards, since the area had no gold or silver.

The powerful Inca Empire had its capital in Cuzco (now in PERU) and occupied a large swath of land along western South America. The heart of the empire was conquered in the early 1530s by Francisco Pizarro, and from Peru expeditions pushed north into ECUADOR and

COLOMBIA and south into CHILE. The Amazon basin was first explored in 1541 and 1542 by Francisco de Orellana, who descended the river in search of the legendary chief El Dorado and his golden kingdom.

Explorers also ventured to the Guiana Highlands, where they generally established only isolated and often temporary outposts. On the eastern seaboard, *conquistadores* founded BUENOS AIRES, in what is now Argentina, in 1536 and Asunción, in present-day PARAGUAY, in 1537.

## SPANISH AMERICA

By the 1550s, Spanish America was governed as two large administrative regions called vicerealties, each headed by a representative of the king. The viceroyalty of New Spain included Mexico, most of Central America, and Spanish territories in the Caribbean. The viceroyalty of Peru encompassed what is now PANAMA and almost all of Spanish South America. The major permanent settlements were in central Mexico and in the ANDES MOUNTAINS, and many of the new urban areas were built on an existing native city or town. A few Spaniards dominated a vast indigenous population by relying on existing native hierarchies and practiced unjust systems of work, the *haciendas* and the *mita*.

The only Spanish port allowed contact with the Americas was Seville and later Cádiz, from where many people sailed to the New World, at first landing mostly in Mexico and Peru.

The Spanish colonial system in the Americas was maintained by agriculture, mining, and the resulting commerce. Agriculture was based on large estates (*haciendas*) that depended heavily on the labor of African slaves, who were imported mostly to the sugarcane plantations of the Caribbean and the tropical coasts of the mainland to replace the indigenous peoples who had died. The European nations helped supply the Spanish colonies with African slaves.

Agricultural exports to Europe included corn, cotton, dyes, peanuts, potatoes, tobacco, and tomatoes. Potatoes and corn revolutionized agriculture and became staples of human survival. In return, cattle, wheat, and barley were sent to the colonies, along with manufactured products. American mines provided much gold but mostly silver. Large silver mines labored in Mexico and Potosí, in present-day BOLIVIA. Discovered in 1545, Potosí remained the world's most important silver mine until the late 17th century. The influx of America's precious metals changed European economies, but Spain spent much of it on wars, luxuries for its nobility and for managing the huge empire.





*At its greatest extent in the 18th century, the Spanish Empire included most of Central and South America, as well as important areas in North America, Africa, Asia, and in Oceania.*

In the 16th century, as a consequence of the marriage politics of the Reyes Católicos, their grandson Charles V came to rule the largest Western empire since the Romans, including all of Spain and the colonies, a large share of Italy, the Low Countries, and the Holy Roman Empire. After 1580, under Philip II, Spain also gained control of the Portuguese Empire until 1640.

From the mid-17th century both the colonies and the world started to suffer important changes, and the Spanish Empire began a long period of decline. In the late 1700s, the Americas became an increasing focus of European national rivalries for control of commerce and the international balance of power. Piracy around the Caribbean Sea also intensified, and Spain's contact

with the empire decreased. Still, Spain tried to monopolize commerce with the colonies.

Spanish American societies became more complex and different from Spain's, including rising numbers of creoles, people of Spanish descent who were born in the Americas, and mestizo, people of mixed European and indigenous ancestry. In the 18th century, the population of Spanish America grew considerably, agricultural and mining production surged, and new towns were built. Spaniards founded settlements and missions in what are now California, ARIZONA, NEW MEXICO, and TEXAS.

When Spain lost the Seven Years' War (1756–63) to Britain, Spain gave up Florida but received the territory of LOUISIANA from FRANCE as compensation, recovering Florida in 1779.

In the late 18th century, Spanish Americans increasingly exported tobacco, cotton, sugar, cocoa beans, and indigo dye, and also enjoyed higher output of gold and silver. Responding to growth and trying to improve its control over the colonies, in 1776 Spain decided to create the new Viceroyalty of the Río de La Plata in part of South America. With its capital at Buenos Aires, the new viceroyalty was made up of territories formerly governed under the Viceroyalty of Peru.

### THREAT OF BRITISH POWER

In the 1780s the Spanish presence still extended over much of the continent, but Spain had to face the growing threat of British power and nearby presence of the Dutch and French. Although trade between Spain and its American colonies increased, Spain was unable to prevent other nations from trading with them, and smuggling of foreign manufactured goods increased. The Spanish government increasingly drained American treasure and resources, and the colonists' resistance grew, with Creole leaders of the colonial society seeking more control and freedom to trade in other markets.

In 1796 the British blockaded shipping between Spain and America, and in 1810 people began to revolt against Spanish authorities, their struggle benefiting from the power vacuum during Napoleon's invasions of the Iberian Peninsula. Simón Bolívar liberated Venezuela, Colombia, and Ecuador and assisted José de San Martín, who had released Chile from Spanish control, to obtain Peru's independence. By 1824, Spain had lost all of its mainland possessions.

Cuba and Puerto Rico were the only remaining American colonies, until the Cuban revolt in 1895 trig-

gered the Spanish-American War, won by the United States. In 1898, Cuba became independent, and Puerto Rico fell under the United States' administration. The Spanish-American War ended 400 years of Spanish dominion in the Americas and marked the rise of the United States as a world power.

### ASIA AND OCEANIA

Spain's presence in Asia and the Pacific Islands dates from Magellan's attempt in 1521 to find a westward route to the Spice Islands, which resulted in the first circumnavigation of the globe.

In 1542 Spain reasserted claims to the Philippine Islands, which were named in honor of soon-to-be King Philip II. The colonial capital of MANILA was founded in 1571 on the island of LUZON, becoming an important port center where American silver was traded for Chinese silks and porcelain, which were exported to Mexico and Europe. The main islands first developed as a source of gold and spices, but in the 19th century, as Spain's control over colonial trade declined, they began to specialize in a single export crop, such as sugar, indigo dye, rice, hemp, or tobacco. When the Spanish-American War erupted, the Filipino nationalists proclaimed independence, but following the U.S. victory, Spain ceded the archipelago to the United States.

The Mariana Islands, named for Mariana of Austria, were also visited by Magellan in 1521 and claimed by Spain in 1565. Spain governed GUAM from Manila and in the late 1700s the island becomes a regular stopping place for the ships that sailed between Acapulco and Manila. Like the Philippines, when the United States defeated Spain in the Spanish-American War, Guam became a U.S. possession, but the other Mariana Islands were sold to GERMANY. Spreading across MICRONESIA, the Caroline Islands were first reached by Spaniards in the late 1520s, were claimed by Spain in the 1870s, and in 1899 were also sold to Germany.

### AFRICA AND GIBRALTAR

In North Africa, Spanish expansion started in Melilla and Ifni in 1497 and came to include a number of small coastal exclaves. In the 1500s Spain also made some incursions into present-day ALGERIA, TUNISIA, and LIBYA, and in 1580 acquired Ceuta from Portugal, a stronghold on the North African coast that served as a major Mediterranean port for goods (gold, ivory, and slaves) transported from the interior of Africa across the SAHARA DESERT. A trading post was set on the Río de Oro in 1881, an inlet opposite the Canary Islands in the re-

gion later known as the Spanish Sahara, and in 1884 Spain declared a protectorate over the coast from Cape Bojador to Cape Blanc.

In 1956 and 1958, Spain left Morocco, in 1969 ceded Ifni to that country, and withdrew from Spanish Sahara in 1975 (now known as WESTERN SAHARA), but retained Ceuta and Melilla.

Further south, in the late 1700s, Spain received from Portugal areas in the Gulf of Guinea off western Africa, namely the islands of Fernando Póo (now Bioko) and Annobón (now San Antonio de Palé), and the territory of Río Muni (now Mbini) on the African mainland. In 1858 Spain created the colony of Spanish Guinea and in the 1870s more land was acquired. Catalan migrants established rich cocoa plantations on Fernando Póo. These territories obtained independence in 1968 under the name of the Republic of EQUATORIAL GUINEA.

Strategically located at the the western entrance to the Mediterranean Sea, the rock of GIBRALTAR was ceded to Britain in 1713 and it is still claimed by Spain.

## LEGACIES OF THE EMPIRE

Although the Spanish Empire has vanished, its main legacies endure. In Latin America and in the Philippines, large Catholic populations remain, and Spanish-speakers are now the third largest language group in the world, with more than 350 million people. Spanish is also spoken by many Moroccans.

In Spanish America, the boundaries of the new nations denounced the old Spanish imperial jurisdictional divisions. Many cities retained forms of Spanish urban planning, with a large central square anchored by a church and a city hall and streets radiating out from it. In some places Spanish customs, such as bullfighting and the afternoon siesta, remain. Since the 1950s Spain's economy developed rapidly, and its trade with the former colonies increased. Spain now receives immigrants from former colonies and is a key investor in most Latin American countries.

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## spatial interaction

SPATIAL INTERACTION IS A dynamic flow process from one location to another. It is a general concept that may refer to the movement of human beings such as intraurban commuters or intercontinental migrants, but may also refer to traffic in goods such as raw materials or to flows of intangibles such as information.

While the origin of the term may be traced to French geographers of the early 20th century, Edward Ullman's *Geography as Spatial Interaction* is normally cited as the seminal statement of the concept. In Ullman's conception there were "three bases for spatial interaction" or more fundamentally, three reasons for why things move: complementarity, transferability, and intervening opportunity.

Complementarity refers to the presence of a demand or deficit at one location and a supply or surplus at another without which there is no economic rationale for any movement. A workplace such as a factory or office tower is an example of a place with a demand for labor, while a residential neighborhood provides a source of workers. A sawmill requires logs, while a forest provides them. To adapt a metaphor from physics, complementarity is like a potential gradient with goods and people flowing from a higher energy state, where they are in surplus, to a lower energy state, where they are in deficit. From the realm of PHYSICAL GEOGRAPHY, wind is the flow of air between complementary atmospheric zones: from a high-pressure cell to a low-pressure cell.

The complementary surplus-deficit relationship is commodity-specific, and if the deficit is precisely specified, the direction and distance of movement will depend on the location where there is a surplus of just that kind of good. Complementary relationships may be the impetus for interaction between distant regions, such as the flow of petroleum over thousands of miles from the MIDDLE EAST to Europe, and within regions, such as the flow of shoppers from residential neighborhoods to small convenience stores over a distance of less than a mile or two.

David Ricardo's classical economic concept of "comparative advantage" provides a relative measure of the degree of economic complementarity between two countries based on their opportunity costs. All other things being equal, one nation will export goods to another nation when it can produce a unit quantity at a lower relative cost than the importing nation. In a similar vein, John Dunning's eclectic theory of foreign direct investment predicts that foreign investment will

take place when a firm in one country has such a powerful “firm-specific advantage” that it can overcome the barriers to entry in a foreign country market in which there is a “location-specific advantage” in factor costs such as land, labor, or capital. Thus, foreign direct investment flows from regions with a surplus of capital to regions with a capital deficit, creating the international ownership lineaments that make-up the multinational corporation.

Transferability refers to the cost of overcoming distance measured in real economic terms of either time or travel cost. The cost of overcoming distance is known as the “friction of distance.” If the friction of distance is too great, interaction will not occur in spite of a complementary supply-demand relationship. Friction of distance depends on prevailing transportation technology and the price of energy. In general, the friction of distance has decreased over time, which is the prime factor in globalization and the emergence of megacities. Daily commuter flows, for example, are always subject to a travel time constraint; a couple hours is a typical maximum for the one-way daily journey to work. High-value, low-weight goods such as jewelry are imminently transferable and exported on a global scale, while heavy, low-value goods such as concrete blocks are usually used very close to where they are produced.

Intervening opportunity is the third basis for interaction although it typically is considered as the reason for a lack of interaction between two complementary locations. Complementarity will only generate a flow if there is no intervening, or closer, location. The flow of goods that would otherwise occur between two complementary locations may be diverted to a third location if it represents an intervening opportunity: a closer complementary alternative with a cheaper overall cost of transportation.

However, Ullman noted that the trade-diverting effect of an intervening opportunity could eventually facilitate interaction between more distant complementary locations. In his example, the nearest (intervening) source of logs would justify construction of a short logging railway from the mill to the forest resource and when it was harvested, the railway would be extended to the next intervening opportunity and so on until it ultimately reached a more distant complementary location. Flows to the more distant complementary location might never have been established had the transportation infrastructure not been constructed in a series of incremental extensions to a series of intervening opportunities.

Important forms of spatial interaction such as traffic flows and migration may be predicted and explained based on an analogy with Newton’s model of the gravitational attraction between celestial bodies. Assuming that there is no intervening opportunity, the degree of complementarity between any two regions is proportional to the product of the populations of the origin and destination regions.

The concept of spatial interaction can be traced to French geographers’ notions of *géographie de circulation*, including both the movement of physical objects and the communication of intangible ideas. But its fullest development as the most fundamental of all geographic concepts came in the middle 1950s as the seminal contribution of Ullman.

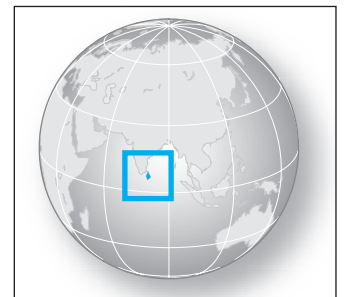
Prior to Ullman, geography had been conceptualized as a way of describing the areal differentiation of sites. With the spatial interaction concept, Ullman shifted attention to situation as a second and equally important locational attribute. Areal differentiation emerged as the outcome of transportation and trade that permitted specialization in particular economic activities and concentrations of various social groups.

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## Sri Lanka

**Map Page** 1123 **Area** 25,332 square mi (65,610 square km) **Population** 19,742,439 **Capital** Colombo **Highest Point** 8,280 ft (2,524 m) **Lowest Point** 0 m **GDP per capita** \$3,700 **Primary Natural Resources** limestone, graphite, mineral sands.





GEOLOGICALLY, THE ISLAND of Sri Lanka is considered a southerly extension of peninsular INDIA's Deccan region and was clearly part of the peninsula all through the last Ice Age. The pear-shaped island is approximately 140 mi (225 km) across at its widest point and about 270 mi (435 km) long and lies just 7 degrees north of the equator. The narrow northern end of the island is almost linked to southeastern India by a chain of limestone shoals known as Adam's Bridge.

Most of the island is flat or gently rolling terrain, although there is a mountainous section in the south-central part of the country known as the Central Highlands that occupies most of the heart of the country. The highland landscape is highly dissected with a unique arrangement of plateaus, ridges, escarpments, intermontane basins, and valleys. There are also a series of spectacular escarpments such as World's End, a near-vertical precipice of about 4,000 ft (1,219 m).

### RIDGES AND VALLEYS

Surrounding this highland is a interestingly diverse plain with elevations ranging from sea level to about 1,000 ft (300 m). To the north and northeast of the highlands, low ridges decrease in altitude as one moves toward the coast, traversing the plain. The western and southwestern parts of the plain feature alternating ridges and valleys that generally run parallel to the coast and increase in elevation toward the interior until they merge imperceptibly with the highland mass. In the remaining parts of the plain, rocky buttes and mounds, some of which reach elevations of more than 1,000 ft (305 m) sporadically interrupt an otherwise flat horizon. Surrounding the plain is a coastal zone consisting mostly of sandy beaches, spits, and lagoons. Over a few stretches of the coast there are rocky promontories and cliffs, deep-water bays, and offshore islets.

Sri Lanka's tropical location ensures perennially high temperatures, with monthly averages of 90 degrees F (32 degrees C) common in the lowlands. Despite its location just north of the equator, the higher altitudes of the Central Highlands account for surprisingly lower temperatures, where monthly averages can range between 44 degrees F (7 degrees C) and 71 degrees F (22 degrees C). Rainfall is the conspicuous factor in the seasonal and diurnal variations of Sri Lanka's MONSOON climate. Most parts of the country receive more than 50 in (127 cm) of rain per year.

However, regional differences created by Sri Lanka's geography have created distinctive wet and dry zones. The wet zone covers the southwestern part of

the island including the highlands. The rest of the island constitutes a relative dry zone, where droughts are common and can persist for three months or more.

Today, the capital is at Sri Jayewardenapura Kotte. Colombo, the former capital (and still the site of many government offices), remains as the commercial capital and the country's largest city. The island has a moderate supply of minerals, but has become known more recently as one of the world's major suppliers of black tea.

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## St. Helena Island

ST. HELENA IS AN ISLAND in the South ATLANTIC OCEAN between Africa and South America. The capital is Jamestown. The Crown Colony of Saint Helena is formed by the island of St. Helena, the islands of Tristan da Cunha (more than 1,300 mi or 2,000 km from St. Helena) and ASCENSION (more than 750 mi or 1,200 km from St. Helena). The island has a population of 6,000.

With an area of 47 square mi (122 square km), St. Helena is extremely remote, lying 1,200 mi or 1,931 km off the west coast of Africa and 1,800 mi or 2,896 km from BRAZIL. St. Helena is a volcanic island, although volcanic activity has long since ceased. The last volcanic eruptions occurred about 7 million years ago and since that time the island has been sculpted into its present form by the forces of erosion. The sea has carved the sheer cliffs that ring the island and streams have incised the deep v-shaped valleys.

### DISPUTED TERRITORY

St. Helena was discovered by the Portuguese in 1502 and was named after the mother of the Emperor Constantine. The island served as a stopover within the middle of the South Atlantic Ocean; its strategic importance for any seagoing nation was evident. The island,

for several centuries, was disputed, especially between the Portuguese, British, Dutch, and several trading companies. In the 18th century, it finally came under the influence of English trading companies (mainly the East India Company), but it took until 1834 for Britain to take it formally under the possession of the Crown.

Despite its enormous importance as a resting and trading place for commercial and military naval activities, St. Helena became famous as a prison for Britain. The best known prisoner of St. Helena was Napoleon Bonaparte of France, who was forced to stay there from 1815 (after Waterloo) until his death on May 5, 1821. On a much larger scale, St. Helena was used as a camp for prisoners of war during the Boer War.

Up to the end of World War II, flax production was a major source of income for the island. Today fishing, coffee, and tourism are the most important factors in the island economy. The importance of shipping to St. Helena decreased in the 19th century with the opening of the Suez Canal, and during the second half of the 20th century, the development of St. Helena was mostly hampered by the lack of an airport, which was under construction in 2004. The Falklands War in 1982 had the most benefit for Ascension Island, but also St. Helena profited from its position on the route between Britain and the Falkland Islands.

The population of St. Helena (known as “Saints”) is a mix of European, African, and Asian descent. Longwood House (the prison of Napoleon Bonaparte) has been, since the times of Queen Victoria and Emperor Napoleon III, legally a part of France within the British Crown Colony. St. Helena has never asked for independence and is still quite dependent on financial contributions from the British taxpayer to maintain a never self-sufficient island economy.

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## St. Lawrence River

THE ST. LAWRENCE RIVER (in French, “fleuve Saint-Laurent”) was formed at the end of the last ice age. It is a 1,900-mi (3,058-km) west-to-east, middle

latitude river connecting the five Great Lakes with the ATLANTIC OCEAN. The French called the river *Rivière du Canada* until the early 1600s, but *fleuve* connotes a river that runs to the sea, a more appropriate designation. Called Kaniatarowanenneh (Big Waterway) in the Mohawk dialect of the Iroquoian language, the river forms a portion of the border between NEW YORK State and the province of Ontario, CANADA, and bisects the province of Quebec.

### GREAT LAKES OUTLET

The river is the outlet for the Great Lakes (the Inland Seas), the five connected freshwater lakes in east central North America that straddle the international border between Canada and the UNITED STATES. Collectively, these constitute the world’s largest body of fresh water, with a water surface of 94,000 square mi (244,000 square km) and 5,500 cubic mi (23,000 cubic km) of water. From west to east, the lakes are SUPERIOR (the largest and deepest), MICHIGAN, HURON, ERIE (the shallowest), and ONTARIO (the smallest). Together, they extend about 850 mi (1,370 km) west to east and 700 mi (1,125 km) from north to south.

The St. Lawrence begins at the outflow of Lake Ontario at Kingston, Ontario, passing Montreal and Quebec City before draining into the Gulf of St. Lawrence, the world’s largest estuary. The major islands include the Thousand Islands near Kingston; the Île de Montreal; Île Jésus (Laval); Île d’Orléans, near Quebec City; and Anticosti Island north of the Gaspé Peninsula. Lake Champlain and the Ottawa, Richelieu, and Saguenay rivers drain into the St. Lawrence. The river widens to approximately 61 mi (100 km) beyond Quebec City.

Ancient inhabitants occupied the river area for at least 8,000 years and Algonquin and Iroquois tribes inhabited the river basin and adjacent uplands prior to European contact. On June 9, 1534, Jacques Cartier first sighted the river and claimed the region for Francis I. The completion of the 9.1-mi (14.5-km) Lachine Canal in 1825 allowed shipping to pass the rapids and navigate Lake Ontario.

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The St. Lawrence begins at the outflow of Lake Ontario at Kingston, Ontario, passing Montreal and Quebec City before draining into the Gulf of St. Lawrence, the world's largest estuary.

## steppe

MANY OF THE WORLD'S wide-open spaces, particularly in eastern Europe and central Asia, are considered to be steppe. A steppe is a plain mostly without trees, dominated by short grasses. This distinguishes a steppe from a PRAIRIE, which is usually qualified as having tall grasses. The word *steppe* is originally Russian, and it is in RUSSIA, UKRAINE, and KAZAKHSTAN where most steppes are found. Variations within areas considered to be steppe include regions that are drier, semidesert, or covered with low shrubs. The term *steppe* can also denote the climate of such regions—somewhat like the dryness of a desert and lacking the moisture to support the growth of trees. Steppe generally has a higher temperature and lower level of moisture than the TAIGA or forested belts further north, but not as extreme as areas of semidesert and desert. Elevations can determine this climate change as well: the slightly

lower basins of otherwise forested SIBERIA can have steppe grasses, while conversely, raised areas amid the steppe become forested, like the Donets Ridge in eastern Ukraine, the mountains of the Crimea, and the LOESS foothills of the Central Asian mountains.

The Eurasian steppes start in the southern parts of MOLDOVA and Ukraine, cross most of southern Russia to the VOLGA RIVER and the southern URALS, and continue across southern Siberia and northern Kazakhstan until they encounter the high mountain ranges of MONGOLIA and northwestern CHINA. Extensions of this broad belt extend south in Russia toward the CAUCASUS, into western UZBEKISTAN, and into eastern Mongolia and northeast China. This west-to-east belt is generally about 125 mi (200 km) wide but narrows in the region immediately to the east of the Volga, where semidesert reaches further north, and at the point at which the band crosses the Urals.

Above this belt is another belt, of similar width, called the forest-steppe, which is a mixture of dry GRASSLANDS and wetter forested terrain. This forest-

steppe belt extends in patches even further east, with isolated segments as far east as the Amur basin between Russia and China.

Drought is a constant feature in the steppe. Natural vegetation consists mainly of short grasses, but the steppe has been cultivated for other crops. Some areas also grow shrubs, and certain parts change from grasses to desert with the seasons. The soils of the steppes, while not as rich as the black earth (*chernozems*) of the forest-steppe zone, are very fertile and, with enough irrigation, can be brought to a high level of productivity, most suitably for wheat and sunflowers. Almost all of the Russian steppe has been brought under cultivation, though much of it suffers from overdevelopment, and the lack of trees makes the steppe susceptible to wind erosion.

Historically, the steppes of Central Asia and southern Russia have been home to nomadic peoples who adapted to their environment by creating a culture constantly on the move. The ancient Scythians were known for their prowess on horseback, and this theme can be traced through most of the other cultures who have lived in this area, including successive waves of Huns, Tatars, Cossacks, Kazakhs, and other Mongol or Turkic peoples.

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## strait

A STRAIT IS A narrow waterway connecting two larger bodies of water. These narrow passageways are sometimes the only way to travel from one body of water to another. They have been important to humans throughout history. Some of the most important straits include Bering Strait, Cook Strait, the Strait of GIBRALTAR and the Bosphorus.

The Bering Strait is located between the easternmost point of Asia and the westernmost point of North America and connects the ARCTIC OCEAN and the Bering Sea. It measures about 55 mi (90 km) in width and ranges from 98 to 164 ft (30 to 50 m) deep. The strait

is named for a Danish-born Russian explorer Vitus Bering, who crossed it in 1728. Two islands, Big Diomedes and Little Diomedes, lie in the middle of the strait. During the last Ice Age, ALASKA and SIBERIA were connected by a land bridge where the strait is now. Many archaeologists believe that some of the ancestors of today's Native Americans crossed this land bridge from Asia about 13,000 years ago. Later, the level of the sea rose, covering the land bridge and creating the Bering Strait.

Another well-known strait, the Bosphorus, separates the European and Asian parts of TURKEY. It connects the BLACK SEA with the Sea of Marmara. The strait is about 20 mi (30 km) long and 2,100 ft (640 m) wide at the narrowest point. The Bosphorus has always been important for the defense of the city of Istanbul, so castles were built on either side of the strait. Anadolu Hisar was built in 1390 on the Asian side, and Rumeli Hisar in 1452 on the European side. Two bridges now span the strait. One of them, the Bosphorus Bridge, is one of the world's longest suspension bridges, at 3,254 ft (1074 m) long. It opened in 1973. A second bridge was completed in 1988. The Bosphorus has been called the world's most dangerous strait. Huge oil tankers use the strait, which is three times busier than the Suez Canal. The strait is very narrow and twists and turns for 29 km (18 mi). Besides tankers, 2,500 commuter ferries a day travel the strait, plus fishing and pleasure boats.

Another dangerous strait is the Cook Strait, separating the North and South Islands of NEW ZEALAND. It was named for Captain James Cook, who discovered it in 1770 when he viewed it from a hill on Arapawa Island. The Maori name for the strait is Ruakawa, meaning "bitter water." The strait is nearly 16 mi (26 km) across at the narrowest point, and 90 mi (145 km) at the widest point. It is 420 ft (128 m) deep. The shores on either side are lined with steep cliffs, and the South Island cliffs have deep bays. Navigation of the strait is treacherous, because of dangerous currents and fierce storms. A submarine cable, laid in 1866, carries electricity from the South to the North Island. The worst shipping disaster in the strait occurred in 1909 when the interisland ferry *Penguin* struck a rock and sunk. Only 30 of 105 people survived. The most recent disaster was the sinking of the *Wahine* in April 1968, after it struck Barrett's Reef during a storm.

Another important strait, the Strait of Gibraltar, is the only natural connection between the ATLANTIC OCEAN and the MEDITERRANEAN SEA. It is well known for the Barbary Apes, who live on the Rock of Gibralt-



tar. SPAIN and Gibraltar lie to the north in Europe, and MOROCCO and Ceuta are on the south side in Africa. The strait is about 984 ft (300 m) deep, about 37 mi (60 km) long, and about 8 mi (13 km) wide. The Strait of Gibraltar is strategically located, since ships that travel from the Atlantic to the Mediterranean must pass through it. Every year about 80,000 commercial freighters use the strait. The strait is also home to several types of dolphins and whales.

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## Sudan

**Map Page** 1114 **Area** 967,499 square mi (2,505,810 square km) **Population** 37,000,000 **Capital** Khartoum **Highest Point** 10,500 ft (3,187 m) **Lowest Point** 0 m **GDP per capita** \$1,330 **Primary Natural Resources** petroleum, iron ore, copper, chromium.



**BORDERED BY THE** CENTRAL AFRICAN REPUBLIC, CHAD, Democratic Republic of the CONGO, EGYPT, ERITREA, ETHIOPIA, KENYA, LIBYA, and UGANDA, Sudan is Africa's largest country. Its north-south extent is the equivalent of the distance between Houston, TEXAS, and the Canadian border. From west to east it would be the distance between Denver and Chicago. The Sudan also is the focus of one of Africa's longest-running civil wars between KHARTOUM and the Arab, Islamic dry north versus the south with its Africans and non-Muslims, but it contains newly discovered oil and natural gas resources.

Created as a modern state in 1956 at the end of a period of British control, northern Sudan has a history dating to pharaonic times in Egypt. This heritage is because Sudan's central geographic feature is the NILE, which means that its people often are referred to as Nilotics.

Sudan's geopolitical position gives it unique importance in Africa. In the north, it is linked to Egypt and North Africa. To the east, it has historic ties to Ethiopia and eventually to the Islamic world via SAUDI ARABIA. To the west are Chad and the Central African Republic. To the south, it is linked most closely with the Africa of Congo, Kenya, and Uganda.

### SUDANESE REGIONS

Physically, the modern state of Sudan can be divided into six largely unique regions, each with a distinct history and human geography:

1) Northern Sudan and the capital of Khartoum. In most respects, this region is like Egypt to the north. It is narrowly defined by a small agricultural strip along the Nile River, and like Egypt, it has links to ports on the RED SEA. Its population is largely Nubian and the area has long seen a strong Arab and Islamic influence from Saudi Arabia.

2) The Central Clay Plains. This is the most agriculturally productive area, which means it also has the largest nonurban population. It shares a border with Ethiopia.

3) Western Sudan. In this semidesert region, the people are primarily pastoralists and non-Arab. However, they are Muslims by religion. It shares a border with Chad and was part of the famous 40-day road for commercial trade from Timbuktu to Khartoum and the Red Sea.

4) Eastern Sudan. This region lies east of the Clay Plains and includes part of the Red Sea coastline and the Qash delta. It has a very strong Arab influence, including major investments in agriculture by Osama bin-Laden. It shares borders with both Ethiopia and Eritrea.

5) The Southern Clay Plains. This area includes the large swamp known as the As Sudd, once a barrier to water transport between the region and Khartoum. The Sudd is approximately the size of BELGIUM. Most recently, the area has been the focus of a prolonged civil war. It shares borders with the Central African Republic as well as Ethiopia. Long a source of slaves for the slave trade, oil was discovered here in the 1970s and so those in Khartoum in the north now seek to extract this resource.

6) The Ironstone Plateau. This area lies south of the Southern Clay Plains and the As Sudd. It shares borders with Congo, Uganda, Kenya, and Ethiopia and thus is more African than Arab. Of major importance is that this is a wet region with abundant precipitation and large areas of dense forest. In December 2003, the

combatants in the long and bloody civil war finally agreed to cease hostilities and divide oil revenues equally.

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## Sumatra

SUMATRA IS IN Southeast Asia and is the sixth-largest island in the world. It is part of the country of INDONESIA. The island was largely under Dutch control beginning in the 17th century but joined newly independent Indonesia in 1949.

Sumatra runs northwest-southeast for about 1,060 mi (1,700 km). The island sits on the southern edge of the massive Eurasia lithospheric plate. The northeastward moving Indo-Australian plate is subducting beneath the Eurasia plate to create the Sunda ocean trench, just off the island's southern shore. The subduction of the Indo-Australian plate is responsible for the island's frequent earthquakes and volcanic eruptions. The mist-shrouded Barisan Range is a volcanic chain and the mountainous backbone of the island. Situated in the intertropical convergence zone, the climate of the island is a wet, tropical rainforest type. Sumatra's forests and swamps are home to many endangered species of mammals, including the orangutan and the Sumatran rhinoceros, tiger, and rabbit, as well as endangered birds, such as the Sumatran cochoa and ground cuckoo. The government manages several large blocks of intact forest as wildlife preserves, but illegal logging and poaching threaten the great diversity of life in these areas.

Sumatra sits astride important seafaring trading routes, so that historically, it has been a crossroads of cultural influences from the MIDDLE EAST, INDIA, CHINA, and elsewhere in Asia. Dutch colonial rule (1824 to 1949) is the most notable period of European impact. About 46 million people live in Sumatra, but the island's population density is relatively low because of its large size. The main urban centers are Medan (2.5

million people) and Palembang (1.5 million people). The people are of Malay stock. They speak 52 different languages, but they are closely related and the people share the religion of ISLAM. The three main ethnolinguistic groups are Acehnese (3.4 million), Batak (3 million), and Minangkabau (3.5 million). The Acehnese have a tradition of militancy and resistance to outside control. An armed insurgency has been active in ACEH in recent decades. The Batak dominate in the highland interior of Sumatra Utara Province. The Minangkabau dominate along the coasts of Sumatra Utara and Sumatra Barat and other scattered areas. Ethnic Chinese and Indian merchants also have an important presence in urban centers.

The island's economy is underdeveloped. The Barisan Range contains small deposits of coal and gold. The fertile soils of mountain basins, such as Lake Toba basin, are a basis for coffee exports. Batak hill people export textiles from the highlands. The lowlands export palm oil. The shallow waters along the east coast are productive fisheries. The northern end of the island possesses one of Indonesia's largest reserves of petroleum oil and natural gas. Multinational corporations such as ExxonMobil have drilling operations there.

Sumatra took a direct hit from the TSUNAMIS generated by a major earthquake that took place in the INDIAN OCEAN on December 26, 2004. Including the Aceh territory on Sumatra, the island suffered some 100,000 casualties from the destructive waves.

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## sunspots

SUNSPOTS ARE DARK, roughly circular features on the solar photosphere. They appear dark because they are cooler than surrounding parts of the photosphere—7,000 degrees F (4,000 degrees C) as compared to 11,000 degrees F (6,000 degrees C). Most sunspots are about 20,000 mi (32,000 km) across, wider than the

Earth's diameter, with a dark central umbra and a lighter penumbra.

Sunspots form in pairs with opposing magnetic polarities lying in an east-west orientation. Spots in the sun's northern hemisphere have the opposite polarity of spots in the south. For instance, if spot pairs in the northern solar hemisphere have their north-seeking spot to the east, pairs in the southern solar hemisphere will have their north-seeking spot to the west.

Sunspots follow recognizable cycles, in which they form at progressively lower latitudes. Sunspots in any given cycle show a polarity pattern opposite of the sunspots in the previous cycle. However, when one cycle is giving way to the next, it is possible to find spot pairs characteristic of the old cycle still forming near the solar equator while spot pairs characteristic of the new cycle begin forming near the poles.

The primary cycle of rising and falling sunspot activity lasts 11 years, but astronomers have detected larger cycles of peaks and valleys in sunspot activity. Roughly every 70 years, there is a period known as the Maunder minimum in which the sun produces almost no sunspots.

Sunspots are effectively magnetic "storms" and are believed to be formed because the sun's extremely powerful magnetic field becomes twisted because various latitudes rotate at different speeds. Lines of force in the solar magnetic field form bundles of tubes beneath the surface, but where they are kinked by rotational forces, sections are forced to the surface, forming pairs of sunspots.

Because sunspots produce large quantities of charged particles that spew out into the solar system, they have effects on and around the Earth. Satellites have had their electronics burned out by the sudden influx of charged particles. Because the atmosphere expands as it is heated by these charged particles, low-orbiting satellites can be slowed enough to be lost. Charged particles also change the altitude and intensity of the Kennelly-Heavyside layer in the ionosphere, interfering with radio transmissions in the AM broadcast and citizen's band (CB) frequencies, and can even damage ground-based electronics. The first recorded incident occurred in 1859, when sunspot activity shut down telegraph communications in FRANCE.

Sunspots are also responsible for the auroras, the northern and southern lights. During periods of high sunspot activities, the residents of such northern cities as SAINT PETERSBURG, RUSSIA, and Anchorage, ALASKA, are treated to curtains of colored light that shimmer and dance across the nighttime sky.

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## Superior, Lake

LAKE SUPERIOR IS THE coldest, deepest and largest of the Great Lakes, a group of lakes located along the border between the UNITED STATES and CANADA. Moreover, Lake Superior has the largest surface area of any freshwater lake, worldwide, at 31,700 square mi (82,100 square km). To put its size into perspective, its waters could, according to the Great Lakes Information Network (GLIN), "fill all the other Great Lakes plus three additional Lake Eries."

GLIN was referring to Lake ERIE, Lake HURON, Lake MICHIGAN and Lake ONTARIO, a set of four lakes of significant size that, along with Lake Superior, comprise the original five Great Lakes; perhaps they were also including Lake Champlain, which was given the designation of the sixth Great Lake in 1998.

Lake Superior has a volume of 2,900 cubic mi (12,100 cubic km), the largest-volume lake in North America, and the third in volume worldwide. The average depth of Lake Superior is 483 ft (147 m), with the deepest portion reaching 1,332 ft (406 m). Its length is 350 mi (563 km) and its breadth 160 mi (257 km), with a shoreline that, including its islands, measures 2,726 mi (4,385 km). This lake is 600 ft (183 m) above sea level and has an average temperature of 40 degrees F (4 degrees C). The lake's drainage basin, the area of land where streams and rivers drain into the lake, is 49,300 square mi (127,700 square km) and is located in MICHIGAN, MINNESOTA, WISCONSIN, and Ontario, Canada. In Canada, the drainage basin rests on rocks that are 1 to 2 billion years old.

The Great Lakes formed slowly; 600 million years ago, a shallow sea covered that area, and sand and silt deposited there gradually compressed into limestone, sandstone, and shale. The sea eventually dried up and about 1 million years ago, thick glaciers advanced and retreated over the land, carving large holes in soft sandstone and shale. Approximately 10,000 years ago, the last glacier retreated. As the Earth warmed up, the re-

sulting water—called meltwater—filled the holes carved out of sandstone, and the Great Lakes were formed. Lake Superior, in particular, has low levels of dissolved minerals; hard Precambrian rocks of the watershed beneath the lake are not easily dissolved.

### SHIPWRECK COAST

French explorers named the lake Lac Supérieur, meaning “Upper Lake.” They chose this name because Superior is located above Lake Huron; its waters flow into Lake Huron through St. Mary’s River. The Native American name for this body of water was Kitchigummi, meaning “great-water,” mentioned in a well-known song, “The Wreck of the Edmund Fitzgerald,” by Gordon Lightfoot. This song highlights the propensity of shipwrecks in Lake Superior, in part because of its ferocious waves; a length of shoreline is known as Shipwreck Coast and a nearby area is called the Graveyard of Ships.

Although the shipwreck connection provokes many tales of ghosts, much life abounds in its waters; 78 species of fish have been observed in Lake Superior, most notably the whitefish and lake trout. This fish population was reduced because of overfishing; the introduction of the sea lamprey, an eel-like creature, contributed further to that reduction. Effective measures, however, have been taken to reverse this trend in fish stocks.

Lake Superior has a retention time of 191 years, which means that, on average, a molecule of water that enters the lake’s confines will remain there for 191 years. Therefore, contaminated water that enters the lake will remain there for a significantly long time as well. Nevertheless, Lake Superior has not been subjected to the same levels of pollution as other Great Lakes, in part because its shorelines are more sparsely populated than those of other lake regions. The United States and Canada are therefore using this lake as a model in restoration and have created a program to restore and protect the Lake Superior Basin as the basis for their overall Great Lakes restoration plan. The plan focuses on the entire air-water ecosystem of Lake Superior.

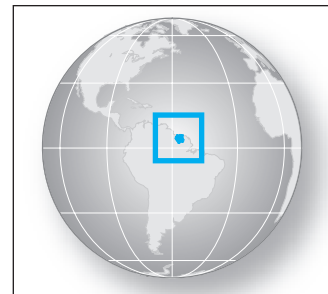
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## Suriname

**Map Page** 1140 **Area** 63,039 square mi (163,270 square km) **Population** 435,449 **Capital** Paramaribo **Highest Point** 4,059 ft (1,230 m) **Lowest Point** -6.6 ft (-2 m) **GDP per capita** \$3,500 **Primary Natural Resources** timber, hydropower, fish, kaolin.



SURINAME IS THE SMALLEST independent country in South America. Known formerly as Dutch Guiana, it has had a troubled history since independence in 1975, in part because of conflicts between its very different populations of varied East Asian and African background. Stabilization since the 1990s has brought renewed ties to the international community, both for foreign investment and for badly needed economic aid from the NETHERLANDS.

Like its neighbors, GUYANA to the west and FRENCH GUIANA to the east, Suriname is one of the most underpopulated and extensively forested areas of the world. Most of the Surinamese live along the narrow coastal plain (about half the population in the capital city of Paramaribo), with scattered settlements—notably of indigenous Carib and Arawak tribes—in the interior. The interior RAINFORESTS are also home to several groups known as Maroons (also called Bush Negroes), descendants of escaped slaves from the 17th and 18th centuries, who have retained many customs of their west African ancestors (dance, architectural style, dress, and parts of African languages). Attempts to forcibly resettle these groups (or to set up logging concessions) met with fierce resistance and a guerrilla movement in the 1980s.

### AGRICULTURAL PRODUCTS

Some of the northern coastal plain has been drained and cultivated for paddy rice and other agricultural products. Other tropical products include bananas, coconuts, and shrimp from the area’s many estuaries.



There is also a large lowland lake, with one of the world's most curious names: Prof. Dr. Ir. W.J. van Blommestein Meer.

The interior rises to highlands, in which the country's mineral wealth can be found. The chief of these is bauxite, produced from weathered granite rocks in tropical conditions, used to produce aluminum. Bauxite production generates around 15 percent of the gross domestic product and 70 percent of all export earnings. At the furthest inland point are the Tumuc-Humac Mountains on the border with BRAZIL.

The Guiana coast was settled and contested variously by the three European powers of England, FRANCE, and the Netherlands in the 17th century. In 1667, the Dutch received all of what was then known as "Surreyham" (named for the English county Surrey), including much of what is now Guyana, in exchange for New Amsterdam (renamed New York City). Early settlers grew tobacco and cotton, and later started larger plantations for the chief cash crop of the Caribbean region, sugarcane. The Dutch were used to building dikes and drainage systems (half of the Netherlands is below sea level), so this portion of the coast thrived.

After the abolition of slavery in Dutch colonies in the early 19th century, indentured laborers were brought in from Dutch colonies in Southeast Asia, who brought rice paddy cultivation with them. Rice is today a larger economic activity than sugar. As all three colonies explored inland toward the mineral-rich highlands, boundary disputes came forth, which remain to this day.

Many Javanese Muslims left Suriname in the 1970s, fearing discrimination from the larger Christian and Hindu populations. Almost 40 percent of the population, most of them educated or skilled, left the country, which fell into further chaos after a bloody military coup in 1980. Free elections began again in the 1990s, but the country remains very divided.

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## surveys, land

IT IS POSSIBLE THAT from our very earliest origins, modern humans have had an interest in putting things into perspective; being able to say where things are. As the Earth's population grew and hunting grounds became more removed from the places people lived, there was a need to be able to tell others how to get there. Or perhaps on meeting others, there was some need to tell them how to get to their village or water or good hunting. Such early descriptions were often based on physical features that stood out in the landscape; important points of reference that would be recognizable from a distance.

With time and human development, it is also likely that such descriptions were sketched in the dirt, or drawn on a rock for increased clarity. These early maps, whether oral or physical, were simple reference devices where distance and accuracy were not as important as relationships and how long it might take to go so far. When the Greeks, very early in the 5th century B.C.E., came to view the world as a sphere, there was a need for increased precision so that places might be properly positioned on maps. But there was no standard format at the time, and as far as we know, the early Greeks had no knowledge of spherical trigonometry; something that is necessary if you are going to map a globe. That meant that most early mapping efforts were built around geometry, a mathematical skill well developed by the Greeks and Egyptians.

The use of geometry probably has its origins in architecture, where both angles and distance were critical to the layout of buildings both on the ground and during construction. To begin a building, you first needed to define the space it would occupy on the ground, a system we today describe as surveying. Because construction has been one of the identifying features of human existence, surveying has been an essential element in the development of the human environment since the beginning of recorded history.

Land surveys can be traced back even before the Egyptians, who, every year after the Nile River overflowed its banks and washed out farm boundaries, would reestablish the boundaries by surveying. The nearly perfect squareness and orientation of the Great Pyramid of Giza, built c. 2700 B.C.E., is clear affirmation of the ancient Egyptians' command of surveying. Even today, it is a requirement in the planning and execution of nearly every form of construction. Its most familiar modern uses are in the fields of transportation, building, apportionment of land, and communications,

all of which depend on the fundamental functions of measuring the Earth and boundaries upon it. Surveying has also been one of the more notable forms of work for many famous Americans including names such as George Washington, Daniel Boone, Captain John C. Frémont, Thomas Jefferson, and LEWIS AND CLARK.

Land surveys, however, are quite different from building surveys where corners are established and distance measured with precise geometry. As indicated above, the earliest land survey techniques relied on physical features as points of reference, and by connecting points it was possible to describe an area or territory. And of course, once territory is described, boundaries are created. This system of describing points with direction came to be known as the metes and bounds survey system and was used extensively in Europe prior to the founding of the UNITED STATES.

The original colonies continued the British system of metes and bounds until 1785, describing property lines based on what meets the eye and bounds (boundary lines) drawn by humans. A typical yet simple description under this system might read, “From the point on the north bank of Ten Mile Creek one mile above the junction of I-70 and Middle Creek Road, north for 400 yards, then northwest to the large standing rock, west to the southwest corner of the municipal pump house, south to Ten Mile Creek, then down the center of the creek to the starting point.” The problem with this system was that sometimes these important points of reference such as the big standing rock or the course of a stream or river might change or become obsolete.

The metes and bounds system was also used to describe towns, which were generally rectangular shaped, 4 to 6 mi (6 to 10 km) long per side. Within this boundary, a map or plat was maintained that showed all the individual lots or properties. In the 1783 Treaty of Paris recognizing the United States, Britain also recognized American rights to the land south of the Great Lakes and west to the MISSISSIPPI RIVER. The Continental Congress passed the Land Ordinance of 1785, creating the Public Land Survey System. The law was later modified when Congress passed the Northwest Ordinance of 1787 to control the survey, sale, and settling of the new lands. The system is in use in all states except the first 13 and VERMONT, TEXAS, and HAWAII. The basic units of area under the system are the township and section, and it is often referred to as the rectangular survey system.

The Public Land Survey System is coordinate-based, with all distances and bearings made from

north-south-running meridians and east-west base lines. In 1796 the office of U.S. Surveyor General was created to survey lands as the nation expanded westward with distances measured using chains and links. A chain measured 66 feet long, contained 100 links of 7.92 inches each, and 80 such chains put together equaled 1 mile.

### COMPASS ALIGNMENT

Alignment was determined using a compass or a solar compass. In areas where measuring by chains was not possible, such as lakes or hilly terrain, distances were calculated using triangulation. To demarcate the boundaries of townships and sections, surveyors usually needed to establish a baseline for east-west measurement and meridian for north-south measurement. Using these lines as reference points, surveyors would place monuments (typically wooden posts) at township and section corners and at quarter-section corners.

To ensure that these corners could be found if the posts were destroyed, surveyors also marked “bearing trees” or other more permanent objects nearby. In prairie areas, they built earth mounds around the posts, and when a corner fell in a body of water, a “meander corner” was established until a true corner could be determined by triangulation or direct measurement. Meander corners marked the intersection of section lines and a water body. A “witness corner” was used to designate a section or quarter corner when it was located where it was impractical to place a monument.

The largest subdivision of land is the Public Land Survey Township, which measures 6 mi square (36 square mi or 93.25 square km). Each township contained 36 sections, and each section (640 acres or 259 hectares) has an area of 1 square mi (2.6 square km). Each township is numbered based on its relative position from these lines starting in the northeast corner. The first row is numbered east to west, while the second row (sections 7 through 12) is numbered west to east. This process continues until section 36 is reached in the southeast corner. In this context, township becomes a unit of length as well as area. Township boundaries are multiples of 6 mi (10 km) north or south of the baseline.

The unit of length for east-west measurement is the range; range boundaries are multiples of 6 mi (10 km) east or west of the meridian. The result is a spatially coordinated section designation such as T2N, R3E. There are five major exceptions to the application of this system: LOUISIANA, Texas, CALIFORNIA, Hawaii, MAINE, and OHIO.

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## Svalbard and Jan Mayen

Two territories of the kingdom of NORWAY, Svalbard and Jan Mayen are outposts for hunting, mining, and scientific activity far to the north of most human settlement. The islands are located north and northwest of Norway, within the southern limits of Arctic sea ice—the northernmost point of Svalbard is within a 620 mi (1,000 km) of the North Pole. Svalbard is approximately 24,570 square mi (63,000 square km); Jan Mayen is approximately 145 square mi (373 square km).

Svalbard is an island group consisting of nine main islands: Spitsbergen (the largest), Nordaustlandet, Barentsøya, Edgeøya, and smaller islands, plus the small island of Bjørnøya further to the south. Spitsbergen has Svalbard's only settlements, the Norwegian administrative capital of Longyearbyen and nearby Barentsburg, the Russian mining community. Jan Mayen is a single island, dominated by a towering active volcano, Beerenberg, which had its last eruption in 1985. It is located off the eastern coast of GREENLAND, 370 mi (600 km) north of ICELAND.

Neither location has much vegetation; they are barren but for some moss and grass. About 60 percent of Svalbard is covered by glaciers, and its terrain consists primarily of mountains and fjords. Both have modified climates for their extreme northern latitude, thanks to the influence of the GULF STREAM which brings warmer water from as far away as the Gulf of Mexico. The point where the warmer southern waters mix with the cold Arctic waters, particularly in the western coasts of Svalbard, provides rich feeding grounds for seals and whales, the primary initial attraction to human exploration of the region, as early as the 12th century. Willem Barents explored the islands in 1596.

Jan Mayen was discovered in 1614 by a Dutch whaling captain, Jan Jacobs May van Schellinkhout, though the Vikings may have known of its existence

earlier. Whaling was the predominant activity in the 19th century. Coal became the primary commodity in the early 20th century, with the establishment of the first mine by John M. Longyear (giving his name to Longyearbyen) in 1906. The Svalbard Treaty of 1920 recognized Norway's sovereignty and forbids naval bases or fortifications but gives the other 40 signatories equal mineral exploitation rights. Only RUSSIA currently maintains a mine operation, but it seems to be for as much political reasons as economic. Neither Russia's nor Norway's mines are very profitable, so it is reasonable to suspect their presence is simply insurance given Svalbard's proximity to northern ports and shipping lanes. Other economic activity includes some trapping of foxes and even polar bears.

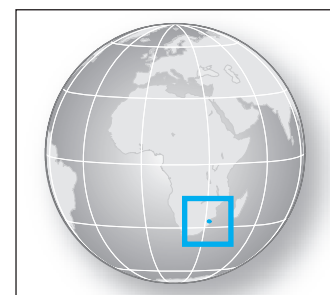
Norway claimed sovereignty over Jan Mayen in 1929, having continually run a meteorological station since 1921. It is administered separately from Svalbard through the Norwegian Defense Communication Service. Aside from the main radionavigation system LORAN (Long Range Navigation), built by NATO (NORTH ATLANTIC TREATY ORGANIZATION) in 1959, Jan Mayen is also home to several scientific stations, including seismographic stations near Beerenberg, the northernmost active volcano in the world. NORSAR was set up to verify compliance of signatories of the Comprehensive Nuclear Test Ban Treaty using sensitive seismic measurement equipment.

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## Swaziland

**Map Page** 1116 **Area** 6,704 square mi (17,363 square km) **Population** 1,161,219 **Capital** Lobamba **Highest Point** 6,108 ft (1,862 m) **Lowest Point** 68 ft (21 m) **GDP per capita** \$3,800 **Primary Natural Resources** asbestos, coal, clay, cassiterite.



THIS TINY, LANDLOCKED, southern African monarchy is surrounded by the Republic of SOUTH AFRICA on three sides and MOZAMBIQUE on the east. Pine forests cover its western mountains, giving way to wide, rolling, central grasslands, then a low grassy plain, bounded by the high, narrow Lebombo Mountains on the east. Four main rivers flow eastward across the country—the Ingwavuma, Komati, Umbuluzi, and Great Usutu—supplying water needed to irrigate crops and to run hydroelectric power plants.

According to Swazi legend, in the late 18th century, Chief Ngwane II led a small band of followers over the Lebombo Mountains, found other African peoples, made peace with them, and together became what today are the Swazi.

British traders and Dutch settlers arrived in the 1830s and discovered gold, prompting a gold rush and negotiations in which the Swazi king and his advisers were pressured to sign documents granting the Europeans rights to mine minerals and to use the land for farming and grazing. The Swazi leaders could not read and did not realize that they were giving away their land and its riches. In 1894, Dutch settlers established the South African Boer Republic, which included Swaziland.

### BOER WAR

However, in 1902, the British won the Boer War and took control until Swazi independence was granted on September 6, 1968. In 1973, King Sobhuza II ordered a new constitution written reflecting national traditions, including polygamy and the rule of the Ngunwenyama or king as the country's hereditary head of state, assisted by a council of ministers and a national legislature. The Ndlovukazi, mother of the king, is in charge of national rituals. If she cannot serve, one of the king's wives is appointed Ndlovukazi. Sobhuza II died in 1982 after a reign of 61 years and was succeeded by his teenage son, Prince Makhosetive, who took the name King Mswati III.

Swaziland has been popular tourist spot for South Africans for decades and has a number of lavish resorts. Wildlife abounds at Hlane Royal National Park in the eastern plains and five other national nature reserves. The official languages are English and Siswati. More than 80 percent of the population practices subsistence farming.

Swaziland has rich mineral deposits, large forests, and good farm and ranch land. However, most of the mines, processing plants, and profitable farms are owned by Europeans of South African origin. Sugar

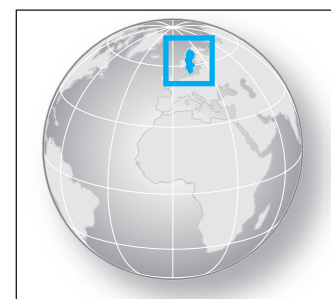
and wood pulp remain important foreign exchange earners. Overgrazing, soil depletion, drought and floods remain problems although large hydroelectric dams have been built on the major rivers. More than one-fourth of the population needed emergency food aid in 2002 because of drought, and more than one-third of the adult population was infected by HIV/AIDS. The predominant religion is Zionism (50 percent), a mix of Christianity and Swazi tradition.

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## Sweden

**Map Page** 1130 **Area** 173,732 square mi (499,964 square km) **Capital** Stockholm **Population** 8,878,085 **Highest Point** 6,024 ft (2,111 m) **Lowest Point** 0 m **GDP per capita** \$25,400 **Primary Natural Resources** zinc, iron ore, lead, copper, silver, timber.



SWEDEN IS ONE of the four Scandinavian countries of northern Europe. Like its neighbors NORWAY and FINLAND, Sweden is a long country from south to north, encompassing climatic variation from the relatively temperate south to subarctic areas north of the ARCTIC CIRCLE. The majority of the Swedish population is concentrated in the far south, across the straits from Denmark, leaving the rest of Sweden mostly empty. One of the key features of Sweden is its wilderness, with forests covering over half of the country.

In a country with an area slightly larger than CALIFORNIA but a population five times smaller, Swedes have always cherished individual space and freedom. This has evolved into the traditional Swedish characteristic respect for individual rights and for the environment. This character, combined with the stability derived from a complete lack of warfare, internal or



external, since the beginning of the 19th century, has created a modern society with one of the strongest economies in Europe and the best social welfare system in the world.

Sweden shares a long border with Norway along the mountainous spine of the Scandinavian Mountains. To the east, Sweden has a long coastline along the Baltic Sea and the Gulf of Bothnia. Most of Sweden's many rivers flow east from the mountains down to the sea. Several of these rivers pass through long, narrow lakes that are marks of the retreating glaciers from the last ice age. Some of the larger such glacial depressions are now filled with large lakes, notably Sweden's largest, Vänern, and Vättern, in the south-central part of the country. Where another of these lakes, Mälaren, meets the Baltic, it has formed a large archipelago, on which is built the city of Stockholm. Sweden also has two large, mostly flat islands in the Baltic, Gotland and Öland. Besides Stockholm, there are two other large cities: Göteborg and Malmö.

Sweden's 21 counties, or *län*, can also be grouped into historic provinces—Västerbotten, Norrland, Skåne, Svealand, and Götaland. The last two of these older provincial names reflect the names of some of the original tribes who eventually merged to form the Swedish nation: the Svears and the Goths. These northern Germanic peoples were known as the Vikings in their heyday of the 9th to 11th centuries. A single kingdom was forged in the Middle Ages and remained in relative obscurity until the 17th century, Sweden's golden age, when the kingdom extended its control across the Baltic, including Finland, ESTONIA, LATVIA, and the northern coasts of POLAND and GERMANY.

Swedes even entered the Atlantic trade market, establishing colonies in the Caribbean (present-day St. Barthélemy) and North America (today's DELAWARE). Low population and limited raw materials, however, could not support a large empire, and by the end of the 18th century, the Swedish empire had collapsed. Finland was lost to Russia in 1809 but compensated for by Norway in 1814, though the two countries were virtually independent until the actual separation of Norway from Sweden in 1905.

Since then, Sweden has transformed itself from a poor agricultural nation to one of the industrial powerhouses of Europe, mostly through high-quality export products. Swedish machinery and technology and other products are famous throughout the world: famous brands include Volvo, Saab, Ericsson, IKEA, H&M, and Absolut. Much of this "Swedish economic miracle" was achieved by using Sweden's enormous

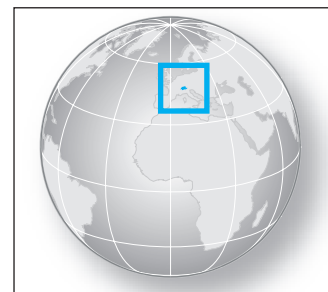
wealth of forests, ore and hydroelectric power. Information technology and biomedicine are two areas in which the Swedes are leading in new global markets. Swedes are willing to cooperate with their neighbors but also guard their independence and neutrality. They are not members of the NORTH ATLANTIC TREATY ORGANIZATION (NATO), they delayed entry into the EUROPEAN UNION (EU) until 1995, and they opted not to adopt the euro currency in 1999. Globally, Sweden is a leader of the nonaligned nations and works to export its own peaceful character to the rest of the world through United Nations organizations and the famous Nobel Peace Prize.

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## Switzerland

**Map Page** 1131 **Area** 15,942 square mi (41,290 square km) **Population** 7,318,638 **Capital** Bern **Highest Point** 15,153 ft (4,634 m) **Lowest Point** 637 ft (195 m) **GDP per capita** \$31,700 **Primary Natural Resources** hydro-power, timber, salt.



THE SWISS CONFEDERATION is a LANDLOCKED country that borders FRANCE to the west, GERMANY to the north, LIECHTENSTEIN and AUSTRIA to the east, and ITALY to the south and southeast. Switzerland is a federal republic that is divided into 26 cantons. It has a bicameral federal assembly, which consists of the council of states and the national council. The president serves as the head of state and government and is elected for a one-year term. Switzerland's major cities are Bern, Zurich, Basel, Lausanne, and Geneva.

Switzerland is a mountainous country with the Jura Mountains to the north and the Swiss ALPS to the south and south east. The central plateau lies between



*A lake in the Gruyere area of Switzerland showcases the kinds of lakes and mountains that comprise the geography of the country.*

the Jura and the Alps, where two-thirds of the population live. The Alps are the source of two major European rivers, the RHINE and the RHÔNE. Switzerland's other major rivers are the Ticino, the Aare, and the Inn. The Alps play a significant role in Switzerland's climate.

The mean temperature at the central plateau is 50 degrees F (10 degrees C) and decreases by 3 degrees F (1.7 degree C) for every 1,000 ft (305 m) in elevation. The climate, however, in the southern slopes of the Alps is Mediterranean, which receives warm breezes from Italy.

Among the earliest peoples to inhabit what is now Switzerland were the Helvetii in the west and the Rhaetians in the east. By the 1st century B.C.E., the Romans had conquered the region and named it Helvetia. In the 4th century C.E., Helvetia was overrun by the Germanic invasions that swept through the Roman Empire and was settled by the Burgundians and the Alamanni. By the 6th century, the Franks conquered both the Burgundians and Alamanni and brought Christianity to the region and subsequently became part of the Carolingian empire by the 9th century. By the 11th century, Switzerland became part of the Holy Roman Empire.

The beginning of the Swiss Confederation dates to 1291, when the cantons of Schwyz, Uri, and Unterwalden rebelled against Habsburg domination and formed a defense alliance. The three cantons defeated Habsburg forces in the battles of Morgarten, Näfels, Sempach, and Dornach. During the 14th century, the alliance grew to include Luzern, Zurich, Glarus, Zug,

and Bern, which formed the core of the Swiss Confederation.

Switzerland was swept in the turmoil of the Protestant Reformation, as the confederation was divided into Catholic and Protestant cantons. Geneva, under John Calvin, became a leading center of Protestantism. Switzerland remained neutral during the Thirty Years' War, and its independence was recognized in the Treaty of Westphalia in 1648.

In 1798, Switzerland fell under the sway of Napoleon's armies and was reorganized into the Helvetic Republic, which replaced the loosely controlled confederation into a republic with a central government. By 1803, after the cantons had rebelled against the government imposed by the French, the former confederation was restored. At the end of the Napoleonic Wars, Switzerland's perpetual neutrality was respected at the Congress of Vienna in 1815, and the Federal Treaty of the same year confirmed the sovereign nature of the cantons.

The experience during the French Revolution spurred the movements for political reform and centralization, which were opposed by conservative cantons of Uri, Schwyz, Unterwalden, Zug, Basel, and Nêuchatel. On December 11, 1845, in response to the closing of some monasteries by the canton of Aargau on the basis of inciting the population, the Catholic cantons of Uri, Schwyz, Unterwalden, Lucerne, Zug, Friburg, and Valais formed a defensive alliance called the Sonderbund, which was forbidden by the Federal Treaty of 1815. In 1847, the Diet voted for the dissolution of the Sonderbund, expulsion of the Jesuits, and the revision of the constitution. A conflict resulted between the forces of the Diet and the Sonderbund, which lasted for 20 days and resulted in 100 casualties. The Sonderbund surrendered, and work began on the reorganization of the Swiss government. On September 12, 1848, a new constitution was proclaimed, which was based on the model of the American constitution.

During the 20th century, Switzerland remained neutral during both world wars, yet because of its neutrality, Switzerland became the site of international agencies such as the International Red Cross, international conferences, and various United Nations organizations. However, the question of Swiss neutrality arose in declassified documents detailing the role of Swiss banks in laundering Nazi gold taken from Holocaust victims and for withholding funds held by Holocaust victims. During the postwar period, Switzerland joined various international organizations that did not compromise its neutrality, such as the Organization for

European Economic Cooperation, the European Free Trade Association, and the Council of Europe. In 1971, women were given the right to vote in federal elections. In 1989, 64 percent of the voters rejected a proposal to abolish the armed forces. In 1999, Switzerland opted not to join the European Monetary Union. In 2002, Switzerland became a member of the United Nations.

Switzerland has a diverse population of Germans, French, Italian, and Romansch, whose languages also serve as the official languages. The Swiss pride themselves in their diversity while preserving national unity in a world full of ethnic strife. However, in recent years, the question of nationality has arisen amid the rise of populist right-wing extremists.

Switzerland ranks among the world's leading industrial economies. Its banking system has been known for its strict client confidentiality, making it a haven for questionable investors. However, in the face of threatened sanctions by the UNITED STATES and other countries, there have been changes in banking practices. In its gross domestic product, services account for 64 percent, industry at 34 percent, and agriculture at 2 percent. The question facing the Swiss people is whether to share their lot with the European Union.

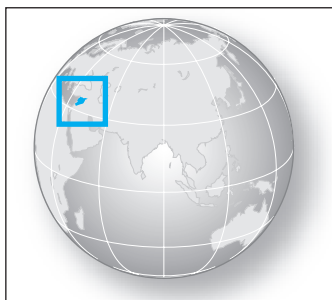
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## Syria

**Map Page** 1121 **Area** 71,498 square mi (185,180 square km) **Population** 19,000,000 **Capital** Damascus **Highest Point** 9,232 ft (2,814 m) **Lowest Point** -656 ft (-200 m) **GDP per capita** \$1,020 **Primary Natural Resources** oil, gas, phosphates, asphalt.



THE SYRIAN ARAB Republic (“Al-Jumhria Al-Arabiya Al-Suria” in Arabic) is a Middle Eastern country located at the southwestern edge of the Asian continent. On the west it borders the MEDITERRANEAN SEA; TURKEY on the north; IRAQ on the east and southeast; JORDAN and ISRAEL on the south; and LEBANON on the southwest.

The Syrian Arab Republic (SAR) is usually called by the ancient name of Syria (“Sham”). Its two major regions, the western and eastern regions, are separated by the Great Rift Valley (Jordan Trench). Within these regions are mountains, plains, and valleys.

The western region lies on the western side of the Great Rift Valley. Its features are the coast, mountains, and river valleys. The coast is a narrow strip of land that runs along the Mediterranean Sea from Lebanon to Turkey. The coast is an important agricultural region that receives enough moisture from the Mediterranean Sea so that irrigation is not necessary. In the south, the Plain of Akkar extends across the border with Lebanon.

Along the coast are sandy beaches alternating with rocky headlands and cliffs. These are spurs of the Jabal an Nusayriyah (Jabal Alawite) range, which runs roughly north and south.

The Great Rift Valley divides Syria's eastern and western regions. The Jordan River rises on Mount Hermon and flows south in the Jordan Trench to the Sea of Galilee. The rift valley then continues north to near the border with Turkey. Its northern end is near Aleppo (Haleb), one of Syria's major cities. The Orontes River flows north in the rift valley (Ghab Depression) along the eastern side of the Jabal an Nusayriyah range through the cities of Homs, Hama, and Apamea before turning west to flow to Latakia on the coast. The fertile Orontes Valley is home to much of Syria's population.

The Anti-Lebanon Mountains (Qalamun Sinnir) form the eastern edge of the rift valley. They contain Mount Hermon. Damascus is east of them at an oasis nourished by the Barada River. The Anti-Lebanon Mountains run roughly northward to near Homs before angling sharply to the northeast as the Palmyra range (Jabal Abu Rujmayn and finally as Jabal Bishri). The Palmyra range is a mountainous area about 3,000 ft (910 m) high that stands above the central part of the plateau. In the north many deep wadis descend from the plateau to the Euphrates.

The Euphrates River rises in Turkey and flows across Syria before entering Iraq. The Tabka Dam on the Euphrates has formed the Assad Reservoir. Further

downstream, the Balikh and Khabur rivers also join the Euphrates as they flow across the Al-Jazirah (upper Mesopotamia) region.

The GOLAN HEIGHTS are a mountain plateau area in southwestern Syria overlooking the Sea of Galilee. Israel currently occupies the area. Eastward is the Jabal ad Duruz in the extreme south of the country. This mountain area is home to the Druze, a secretive Shiite sect of Islam. It is also the source of the Yarmuk River. It crosses southern Syria and part of Jordan before joining the Jordan River. The southern and eastern areas of Syria are the northern part of the Syrian Desert.

This area is located on a plateau that descends from 2,000 to 3,000 ft (610 to 910 m) above sea level at the edge of the rift valley. It gradually descends to a

flat sandy desert plain that joins with the border of Iraq. It also slopes down to the Euphrates River as its eastern boundary. Much of the southern part is a rocky plain. Syria, as part of the FERTILE CRESCENT, contains numerous historic places. One is the ruin of Palmyra, which was a famous caravan city on the Spice Road.

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## taiga

THE FORESTS OF THE world occur in several climatic zones, which range from the subpolar to tropical regions. The taiga is the name given to the forests that border the tundra meadows and dwarf shrublands of polar latitudes where annual temperature regimes prohibit the growth of trees. These forests are dominated by coniferous species.

The name derives from the Russian word for “land of little sticks,” which reflects the impact of climate on tree growth in continental interiors. The greatest extent of taiga occurs in the Northern Hemisphere because of the greater expanse of land between northern latitudes 50 degrees N and 70 degrees N as compared with the domination of ocean in equivalently located southern latitudes. The taiga forms a forest belt across North America and Eurasia, with the tundra on its northern border and the temperate forests and grasslands to the south.

This BIOME is often referred to as the boreal zone though in northern CANADA there are also large expanses of muskeg, a type of wetland/peatland, within the forest. These northern forests occupy some 6.1 million square mi (15.8 million square km); a further .2 million square mi (.5 million square km) of coniferous forest extends along the ocean coast from ALASKA to CALIFORNIA.



Climatic conditions in these regions vary enormously, from harsh continental to more favorable northern maritime regimes. Overall, cold, dry conditions prevail along with a big range of temperature; average temperatures of -22 degrees F (-30 degrees C) occur during the winter, while the average temperature in the summer months is 59 degrees F (15 degrees C). There is a growing season that varies from only 50 days in continental interiors to 100 days in southerly and near coastal regions. The risk of frost is high even during the summers which are characterized by a long day, and the change of seasons tends to be abrupt.

Precipitation is on average 20 in (50 cm), but amounts also vary considerably; coastal areas of Scandinavia and the west coast of North America receive up to 80 in (200 cm). Most precipitation falls as rain in the summer months with some precipitation falling as snow in the winter. The harsh conditions affect soil type in the taiga, which was either directly glaciated or experienced polar desert conditions during the last ice age. Glacial and periglacial deposits are the substrates on which young soils have developed. These are often sandy and acidic with some organic material rich in lignin from accumulating coniferous needles.

Permafrost also occurs but is discontinuous, and the operation of freeze-thaw cycles in soils causes soil movement and the formation of hummocks and hollows. The hollows are favored by trees, mosses, and

shrubs, and the hummocks by lichens. Naturally occurring fire plays a significant role in taiga dynamics. Many conifers require fire to release seeds from their cones, and fire promotes new growth.

The dominant taiga tree type is the conifer with needlelike leaves. Most species are evergreen, which means that they shed needles year-round, the main exception being the larches that dominate the vast expanses of SIBERIA. These are deciduous, which means that they shed their leaves annually. Worldwide, the taiga is a considerable store of carbon, both within the living trees and within the organic material of the soils that derives from the trees. Although there are similarities in the structure or physiognomy of the plant communities in this biome, there is considerable variation in the species composition.

In North America, white spruce, black spruce, and tamarack (a species of larch) are the most widespread, but many other species occur where climatic, topographic, or soil conditions are favorable. Shrubs, grasses, sedges, herbs, lichens, and mosses are also common in taiga communities, while large herbivores, for example, caribou in North America and reindeer in Eurasia, are the most conspicuous animals. A wide range of insects also characterizes the taiga, and sometimes population outbreaks can cause significant defoliation.

Taiga communities can also be classified according to their relationships with adjacent communities. There are four zones, as follows:

*Forest-tundra* (transitional zone between the two major biomes): Stunted trees in isolated stands, lichen- and moss-dominated communities.

*Open taiga* (boreal woodlands): Discontinuous stands of trees and shrubs with lichens and mosses.

*Closed taiga* (boreal woodlands): Continuous stands of trees with a closed canopy, a shrub understory.

*Taiga-mixed forest or taiga-grassland* (transitional zone with southern ecosystems of the temperate forest of grassland): Mixed forests of conifers and deciduous hardwoods or a mixture of conifers in grassland.

Economically, the taiga forests are very important. They provide the raw materials for forestry industries in Canada, the UNITED STATES, Scandinavia, and RUSSIA and are the source of considerable wealth generation. The major products are roundwood, sawnwood and pulp for paper making. Canada is the leading producer of wood products from its forests.

However, much forest exploitation is unsustainable, especially where large tracts of land are left tree-

less by clear felling. The situation is particularly serious in eastern Siberian forests, which are diminishing rapidly. The plight of the taiga rarely achieves the publicity attention or media interest garnered by tropical RAINFORESTS.

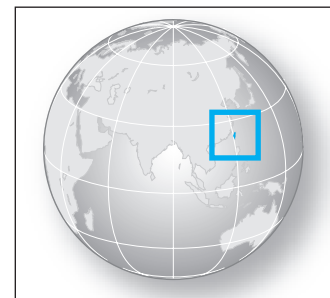
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## Taiwan

**Map Page** 1120 **Area** 13,891 square mi (35,980 square km) **Population** 22,603,001 **Capital** Taipei **Highest Point** Yu Shan 12,962 ft (3,952 m) **Lowest Point** 0 m **GDP per capita** \$18,000 **Primary Natural Resources** coal, natural gas, limestone, marble.



TAIWAN IS A mountainous island in the SOUTH CHINA SEA, with the Philippine Sea to the southeast, Luzon Strait to the south, the Taiwan Strait to the west, and the East China Sea to the north. Taiwan also controls the Pescadores Islands, the Quemoy Islands, and the Matsu Islands. Taiwan is a democratic entity that has a president as the chief executive and a unicameral legislature. Taiwan is divided into 16 counties and five municipalities. Its chief cities are Taipei, Kaohsiung, Taichung, and Tainan. Taiwan's international status remains uncertain because of its dispute with the People's Republic of CHINA, which claims it as a renegade province.

Taiwan's topography consists of mountains along the east and flat to gently rolling plains in the west. The climate is tropical with a rainy season from June to August and cloudy all through the year. The island of Taiwan is susceptible to earthquakes and typhoons. Its chief rivers are the Tanshui and the Choshui.

Human settlement in Taiwan can be traced to some 15,000 years ago during the Paleolithic age. The island's

aborigines are traced to peoples who came from Southeast Asia and are related to the Malay peoples in MALAYSIA and INDONESIA. The first official Chinese contact with the island was in 239 C.E. when the emperor sent an expeditionary force to Taiwan. By the 13th century, Chinese immigrants settled on Taiwan from the province of Fukien on the mainland. (It was not until the Ming Dynasty [1368–1644] when the term *Taiwan* was used to name the island.)

The first Europeans to make contact with Taiwan were the Portuguese in 1517, who named the island Ilha Formosa meaning “beautiful island.” During the 17th century, Taiwan became a Dutch colony administered by the Dutch East India Company. The Chinese settlers on Taiwan, however, did not submit to Dutch rule and rebelled against the Dutch in 1640 and 1652. By 1661, the Dutch had left Taiwan. In 1644, remnants of Ming forces escaped to Taiwan after their overthrow by the Manchus from the north. By 1683, the Manchus subdued all of Taiwan. At the conclusion of the Sino-Japanese War in 1895, the Treaty of Shimonoseki awarded Taiwan to Japan. In many ways, Japanese rule brought stability and modernization to Taiwan through improvements in public health, education, economic infrastructure, and technology. However, the Japanese regarded Taiwan as a colony and imposed their language and culture upon the population.

In 1945, Taiwan became the Republic of China. In 1949, with the victory of the communists on the mainland, Nationalist anticommunist forces fled to Taiwan with the intention of mounting an attack to reclaim China. Mao Zedong had hoped to lead an invasion of Taiwan, but his plans were thwarted by U.S. support of Nationalist leader Chiang Kai-shek. For 20 years, the Republic of China, of which Taiwan was its sole remnant, was regarded as the legitimate government of China. During the 1960s, the tide was turning toward recognition of the People’s Republic of China, most notably by the UNITED STATES which wanted to court BEIJING away from the Soviet Union.

On January 1, 1979, the United States normalized diplomatic relations with the People’s Republic of China. The “One China Policy” was established, recognizing Taiwan as part of China, while continuing to provide for the defense of Taiwan. Between 1995 and 1996, in the midst of presidential elections in Taiwan, mainland China conducted war exercises in the Taiwan Strait. The United States responded by sending two aircraft carrier groups to Taiwan. In 2000, Taiwan experienced its first peaceful transfer of power from the Nationalist Party, which had ruled Taiwan for 50 years,

to the Democratic Progressive Party under Chen Shui-bian.

The population of Taiwan consists of 84 percent Taiwanese. Mainland Chinese make up 14 percent, while the aborigines make up the remaining 2 percent. The official language of Taiwan is Mandarin Chinese, though the Taiwanese and Hakka dialects are widely spoken.

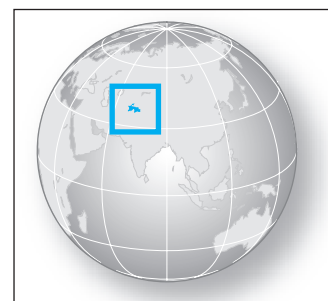
Throughout the post-World War II period, Taiwan had one of the fastest-growing economies in the world. Taiwan has a free market capitalist economy that is one of the largest in Asia. Taiwan’s largest trading partners are China and the United States. Taiwan’s main exports are machinery, electronics, metals, textiles, plastics, and chemicals.

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## Tajikistan

**Map Page** 1119 **Area** 55,251 square mi (143,100 square km) **Population** 6,863,752 **Capital** Dushanbe **Highest Point** 24,591 ft (7,495 m) **Lowest Point** 984 ft (300 m) **GDP per capita** \$1,000 **Primary Natural Resources** hydropower, uranium, mercury.



**LANDLOCKED AND MOUNTAINOUS**, Tajikistan gained its independence in 1991 following the dissolution of the Soviet Union. The Republic of Tajikistan was engulfed in a bloody civil war from 1992 to 1997 and today continues to suffer grinding poverty. Tajikistan is the smallest country in Central Asia, bordering AFGHANISTAN to the south, UZBEKISTAN to the west and northwest, KYRGYZSTAN to the north, and CHINA to the east.

Tajikistan is primarily a mountainous country, dominated by the Trans-Alay and Pamir ranges. A full 93 percent of Tajikistan’s land area is covered by

mountains, with just 5 percent suitable for agricultural production. Notable valleys include the Ferghana Valley in the west, and the Kofarnihan and Vakhsh valleys in the southwest. Tajikistan is home to some of Central Asia's highest mountains, including Pik Lenina (23,400 ft or 7,134 m) and Pik Kommunizma (24,580 ft or 7,495 m). Tajikistan's small size limits the variety of its natural resource base, although hydropower, uranium, zinc, and gold play important roles in the Tajik economy. Tajikistan's climate is classified as midlatitude continental, ranging from polar in the mountains, to semiarid in the Ferghana Valley.

Tajikistan's population distribution is centered on its capital city of Dushanbe with an additional cluster in the heavily populated Ferghana Valley. Unlike other Central Asian neighbors, Tajiks are of Persian rather than Turkic descent. The ethnic mix in Tajikistan includes Tajik (65 percent of the population), Uzbek (25 percent), and Russian (3.5 percent) peoples. While the official language is Tajik, Russian remains the language of government, business, and interethnic communication. As in other Central Asian states, ISLAM is the dominant religion in Tajikistan, practiced by 90 percent of the population. The country's economy is beset by poverty and unemployment.

The country's per capita gross domestic product (GDP) is lowest of all 15 former republics of the Soviet Union and ranks just above MALI and just below BURKINA FASO, two of Africa's poorest countries. The five-year civil war of the 1990s severely damaged vital infrastructure and kept foreign investment at bay. Sixty percent of Tajikistan's population lives below the poverty line, and the unemployment rate is an astounding 40 percent. Employment in Tajikistan is dominated by the primary sector, with agriculture employing 67 percent of the labor force. Even the industrial sector, employing 7.5 percent of the labor force, is largely primary-based, involving the processing of aluminum, zinc, and lead. Agricultural products include cotton, grain, cattle, sheep, and goats. Additional economic concerns for Tajikistan include uneven structural reforms and burdensome external debt obligations.

Perhaps the most pressing geopolitical issue facing Tajikistan is its northwest border with both Uzbekistan and Kyrgyzstan. In this area, seemingly randomly drawn boundaries divide like peoples and unite people with little in common. A number of Tajik exclaves (land sections totally detached from the rest of the country) exist entirely within the borders of Kyrgyzstan. Boundary demarcation is also currently under way for much of Tajikistan's border with China. Other

current issues facing Tajikistan include major narcotics traffic from Afghanistan to the Russian market, and the prevalence of organized crime in Dushanbe.

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## Tanganika, Lake

LAKE TANGANICA IS IN east-central Africa in the Great Rift Valley at an elevation of 2,534 ft (772 m). It is very deep and narrow in typical rift formation with mountains rising out of the lake. According to the Center for Great Lakes Studies, Lake Tanganika is the seventh-largest lake in the world when ranked by area and is the third-largest in the world by volume.

Tanganika is 4,823 ft (1,470 m) deep, making it the second-deepest lake in the world behind Lake BAIKAL in RUSSIA. It is the second-largest lake in Africa, covering 12,700 square mi (32,890 sq km). The lake is 420 mi (680 km) long and up to 45 mi (72 km) wide. It is bordered on the west by the country of CONGO, on the southwest by ZAMBIA, and on the south by both TANZANIA and BURUNDI.

The Malagarasi, Kalambo, Ruzizi, and several other small rivers feed Lake Tanganika. The Ruzizi flows out of Lake Kivu. The Kalambo River is known for having one of the highest waterfalls in the world as it descends 3,000 ft (914.4 m) over 6 mi (9.7 km) through a volcanic gorge. The Kalambo Falls are just one section of this descent in one single spectacular drop of 704 ft (214.5 m). The Lukuga River is the only outlet for Lake Tanganika at Kalema, Congo, on the lake's western side. The Lukuga flows into the CONGO RIVER system, but because it is often clogged with silt it runs only intermittently.

Lake Tanganika, for a very long time, was completely isolated from the rest of Africa's freshwater system. Because of this isolation, there are a large number of fish and other animal species peculiar to the Tanganika area. Up to 25 percent of the 400 species in the area are specific to Lake Tanganika. There is also a large population of hippopotamuses and crocodiles, in-



cluding the rare sharp-snouted crocodile, swimming in Lake Tanganika. There is a large variety of waterfowl and other birds that live around the lake, including ducks, geese, storks, pelicans, cranes, kingfishers, guinea-fowl, quail, ptarmigan, egrets, fly-catchers, eagles, and more. A great diversity of animals live around the lake including elephants, buffaloes, zebras, antelope, lions, leopards, and chimpanzees. The lake also supports the surrounding agriculture where rice, coffee, sweet potatoes, yams, sugar cane, beans, ginger, cotton, and tobacco are grown.

Shipping and commercial exchange is important on the whole length of Lake Tanganika. Fishing is one of the main economies on the lake with many of the natives still using their dugout canoes to fish from. The major port towns include Karema, Congo; Kigoma, Tanzania; and Bujumbura, Burundi. It takes three to four days to travel the length of the lake in a steam ship. During World War I, there were several small naval battles on the lake between the British and the Germans. In 1871, David Livingstone and Henry M. Stanley explored this area and documented it in their journals.

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## Tanzania

**Map Page** 1114 **Area** 364,900 square mi (945,087 square km) **Population** 33,000,000 **Capital** Dar es Salaam **Highest Point** 19,340 ft (5,895 m) **Lowest Point** 0 m **GDP per capita** \$290 **Primary Natural Resources** coal, diamonds, gemstones, gold.



TANZANIA IS A LARGE COUNTRY located on the INDIAN OCEAN in eastern Africa. It was formerly known as Tanganyika. In 1964, Tanganyika united with the Island of Zanzibar to form the United Republic of Tan-

zania. Tanzania is bordered by eight other African countries. KENYA and UGANDA are its neighbors to the north. To the west lie RWANDA, BURUNDI, and the Democratic Republic of the CONGO. ZAMBIA and MALAWI border the southwest. In the south, the country borders MOZAMBIQUE.

The Indian Ocean is the eastern edge of Tanzania. The coast line is over 500 mi (800 km) long. Tanzania, located between the equator and 12 degrees South, is a hot country. Along the coast are many mangrove swamps and coconut palm groves. The coast is always warm, but the temperate highlands can be cool. Tanzania has a tropical wet-dry climate with the rains coming in late November.

### ZANZIBAR

There are three islands off the coast of Tanzania. Pemba Island is the most northern island. It is only 380 square mi (984 square km) in area. To its south is Zanzibar, the largest of Tanzania's islands. Zanzibar Island is the largest of Africa's coral islands, but it is only 640 square mi (1,658 square km) in area. The Zanzibar Channel separates Zanzibar Island from the mainland. This strait is 22 mi (40 km) wide. Both Zanzibar and Pemba are famous for producing the sweet spice cloves. Smaller Mafia Island is to the south.

The bulk of Tanzania is a plateau that rises from the Indian Ocean to an average level of about 4,000 ft (1,200 m). The plateaus are hot with open savannas of grass, thorn trees, and brush. There are many mountains and mountain ranges on the plateaus: The Usambara Mountains are located in northeastern Tanzania; Mount KILIMANJARO, which used to have snow on its peak year-round, is in the northeast.

The Serengeti Plain, famous for its vast herds of African animals, lies in the north on a high plateau between the Ngorongoro highlands and the border with Kenya. South of the Serengeti is the Masai Steppe. Northwest is the southern third of Lake VICTORIA in the extreme north of the country. The OLDUVAI GORGE, which is a 30-mi (48-km) long trench, lies in the Serengeti Plain. Tanzania's western borders include Lake TANGANYIKA in the west and Lake Nysa (Lake MALAWI) in the southwest. These are rift valley lakes formed in the Great Rift Valley. Both lakes have bottoms that are below sea level.

The Hahali Mountains and the Ufipa Plateau overlook Lake Tanganyika. The Kipengere and Livingstone mountains overlook Lake Nyasa. The Malagarasi Swamp in the western central plateau was formed by the geologic rifting of the continent. The south-central

region contains the Great Ruaha Rift. It bounds the Ruaha National Park.

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## Tarim Basin

THE TARIM BASIN designates a major river and great basin located in the Uighur Autonomous Region of Sinkiang of extreme northwestern CHINA, north of the TIBETAN PLATEAU. Tarim also connotes the bank of a river that flows into a lake or that becomes indistinguishable from desert sands. The basin occupies nearly one half of Sinkiang and is encircled by the TIAN SHAN (Celestial Mountains) to the north, the Pamir Mountains on the west, and the Kunlun Mountains in the south. It is 850 mi (13,687 km) east to west and nearly 350 mi (564 km) north to south. The Tarim Basin is also known T'a-li-mu Ho (Wade-Giles Romanization), Tarim He (Pinyin), and Dayan (Mandarin).

The basin comprises 215,000 square mi (557,000 square km), has a central desert with scattered, isolated oases along the rim, and lies at an elevation of 2,500 ft (760 m) above mean sea level in the east, rising to 4,000 ft (1,220 m) in the west. The central desert, Takla Makan (Taklimakan, Taklamakan), covers an area of 105,000 square mi (271,950 square km) and includes at its eastern end the Turfan Depression 505 ft (154 m) below sea level.

The Tarim River flows along the north rim of the Takla Makan desert but constantly shifts its bed and is formed by the confluence of the K'a-shih-ka-erh (Kashgar) and Yarkand rivers to the west, then flows northeast to be joined 230 mi (370 km) downstream by the A-k'o-su and the Ho-t'ien (Khotan) rivers. The Yarkand-Tarim system is 1,260 mi (2,030 km) long and reaches Lop Nor, a saline lake bed, at the eastern end of the basin and drains intermittently into Lake T'ai-t'e-ma (Taitema) 100 mi (161 km) southwest of Lop Nor. The Lower Tarim Basin, an arid plain com-

posed of alluvium and lake sediments, is the driest region of Eurasia.

Archaeological evidence documents that the basin was a part of the Silk Road and that people thrived there from 1800 B.C.E. to 500 C.E. Especially intriguing are the mummified remains of many Caucasoids and Mongoloids. The Tarim became a barrier to Chinese expansion west and Arab expansion eastward. The contemporary local population numbers 5.5 million and is composed of Uighur Muslims (84 percent), Han Chinese (12.5 percent), Kirgiz, Mongols, and Kazaks. The largest city is Kashgar (Kashi) located in the west and the capital is at Wu-lu-mu-ch'i.

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## Tashkent

TASHKENT (ALSO TOSHKENT) is the capital of the Central Asian republic of UZBEKISTAN, which gained its independence when the Soviet Union was dissolved in 1991. Located on the banks of the Chirchik River in the Kyzylkum desert and the foothills of the TIAN SHAN/Pamir mountains, Tashkent is an oasis with a population of about 2.3 million. It enjoys a continental desert climate with an annual range of temperature between 21 degrees F (-6 degrees C) and 91 degrees F (33 degrees C) and a low annual precipitation of less than 15.7 in (40 cm). Nevertheless, it remains a green city with many parks and gardens: Tashkent receives meltwater from its mountain hinterland, also a source of water for the Syr'darya River, which supplies the ARAL SEA and the extensive regional agriculture, which focuses on cotton.

Founded about 200 years B.C.E., Tashkent has benefited from its position at the crossroads of Asia and has been influenced by many invaders and visitors. It developed under the influence of the Sogdians from the east, and nomadic Turkic peoples during the 7th century by which time irrigation was extensive and provided crops and livestock for trade. In 751, an attempted

Chinese invasion was thwarted by competing Arab invaders, who won the day. ISLAM was firmly established as the dominant religion.

As in BOKKARA, the Samanid dynasty prevailed in the 9th century when the city was known as Binkath. It was a thriving trading and religious center until the early 12th century, when the Mongols, under Genghis Khan, destroyed the city. Subsequently, Tamburlane and his successors oversaw a revival and a new building phase. Despite conflicts of interest between local ethnic groups, Tashkent grew as a trading center and came under the influence of, first, czarist Russia in the late 1800s, and then the communist regime from 1918. Some destruction of mosques occurred but the impact of the Russians was slight compared with the earthquake of 1966 that destroyed much of the city.

The modern city is a combination of Russian-style tree-lined boulevards with numerous green squares with fountains, parks and concrete tower blocks and the surviving old quarter with its Uzbek influence. Tashkent, superseding SAMARQAND, became the capital of Uzbekistan in 1930. It is not only an administrative center for the newly emerged state of Uzbekistan of the post-Soviet era but also a trade and cultural center with many museums and theaters with a reputation for excellence in ballet and opera. Its squares have lost many statues of communist leaders and there is an efficient metro system constructed between 1972 and 1977. Museums abound. In old Tashkent, there remain pre-1966 mud-built dwellings juxtaposed with a new Islamic University signifying the re-emergence of Islam.

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## Tehran

THE CAPITAL of modern IRAN, Tehran is one of the largest cities of the world with a metropolitan population of 15 million people. Located on the northernmost limit of the central Iranian plateau, the city is appropriately 3,750 ft (1,143 m) above sea level. To the northeast are the Iranian uplands and the snow-capped Mt. Demovend, legendary home to Zoroaster.

The city's climate is fairly temperate with average summertime temperatures in the upper 70s degrees F (upper 20s degrees C), but close to 32 degrees F (0 degrees C) in the winter. Its rainy season lasts between November and May.

Unlike other Iranian cities, Tehran is not of ancient origin; it is too far removed from the centers of Iranian civilization to the south and west. Its earliest history dates to the 9th century C.E., when Tehran was a small village marked by subterranean dwellings. It remained such a town sitting astride the caravan route that ran across the plateau between Central Asia and Mesopotamia until 1220 C.E., when invading Mongols sacked and completely destroyed the larger nearby city of Ray.

In 1553, the ruling Safavid kingdom made Tehran a second capital, using it as a resort until the decline of the dynasty. Subsequently, the city was sacked by an Afghan incursion that left the city almost deserted. Tehran recovered but remained of secondary importance until Agha Muhammad Khan, the founder of the Qajar dynasty, occupied the city, and because it was close to his tribal lands, he made it his capital in 1788. The Qajar kings enriched the city with palaces, markets, and residences, and Tehran flourished. By the end of the 19th century, city-planning, improvement projects, which included the Sepahsalar mosque, and the first telegraph transformed Tehran into a modern metropolis.

### TEHRAN AREAS

Modern Tehran, which dates to this period, is divided into three large areas. The royal residences and wealthy areas of the city are located in the north. The central part of the city is where the more important government buildings, mosques, and palaces are located. The southern section of the city, however, remained very poor and was dominated by slums and industrial districts.

Reza Shah Pahlavi, who ruled 1925–41, modernized the city by constructing broad thoroughfares connecting the city and beautiful fountains and monuments. The city also became a center of learning with the opening of Tehran University in 1934 and subsequently in 1960 the National University. Tehran also hosted the famous meeting of the Big Three (Josef Stalin, Winston Churchill, and Franklin Roosevelt) during the Tehran Conference of 1943.

Since that time, Tehran continued to expand with its own suburbs. Under Muhammad Reza, the last shah, the city was part of the Great Civilization mod-

ernization effort that saw the building of nationwide highways, dams, and even model cities. The Islamic Revolution and the subsequent Iran-Iraq War interrupted further city development, namely the implementation of a planned metro subway system. In 2004, the city remained overly congested with buses and taxis, leading to instances of high air pollution and traffic accidents.

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## Tennessee

NAMED BY THE Cherokee Native Americans, the U.S. state of Tennessee, which is officially known as the Volunteer State, is celebrated throughout the world as the home of American country music. Tennessee is bounded on the north by KENTUCKY and VIRGINIA, on the south by GEORGIA, ALABAMA, and MISSISSIPPI, on the east by NORTH CAROLINA, and on the west by ARKANSAS and MISSOURI. The MISSISSIPPI RIVER runs along the western boundary of Tennessee. The total area of Tennessee is 42,146 square mi (109,157 square km), making it the 36th state in size. Tennessee's largest cities are Memphis, Nashville (the capital), Knoxville, Chattanooga, Clarksville, Murfreesboro, Jackson, Johnson City, Kingsport, and Franklin.

In this inland state, only 926 square mi (2,398 square km) are covered by water. Tennessee's major rivers are the Tennessee, the Mississippi, the Cumberland, the Clinch, and the Duck. Since most of Tennessee lies within the Mississippi River Basin, natural waterways within the state generally drain either directly or indirectly into the Mississippi River. Tennessee has 25 artificial lakes and reservoirs that have been created by damming river waters. Tennessee lakes include the Kentucky, the Norris, the Chickamauga, the Cherokee, and the Tims Ford Reservoir.

Tennessee's average elevation is 900 ft (274 m) above sea level. The highest point in the state is 6,643 ft (2,024 m) above sea level at Clingman's Dome, and the lowest point is 128 ft (39 m) above sea level at the Mississippi River. The state is approximately 440 mi

(708 km) from east to west and approximately 120 mi (193 km) north to south.

The climate of Tennessee is temperate, and the state experiences warm, humid summers and cool, clear winters. Overall, Tennessee's temperature ranges from the high 20s degrees F (-2 degrees C) in the winter to the low 90s degrees F (33 degrees C) in the summer. Average annual rainfall ranges from 60 in (152 cm) in the mountains to 45 in (114 cm) in more protected areas. Moderate snow is frequent in the winter in Tennessee, but it is not uncommon for mountainous areas to see as much as 15 ft (4.57 m) during winter months.

Tennessee is made up of six geographic regions. The Blue Ridge Region of Tennessee is located along the North Carolina border. This area is covered with high mountains, most notably the Great Smoky, Chilhowee and Snowbird mountains. The average elevation is 500 ft (150 m) feet above sea level in this region, which includes Clingman's Dome in the Great Smoky Mountains. The Appalachian Ridge and Valley Region is a 55-mi (88-km) stretch west of the Blue Ridge Region. This section is filled with fertile valleys interspersed with wooded ridges. The western section of this area is known as The Great Valley.

The Appalachian or Cumberland Plateau is located west of the Appalachian Ridge and Valley Region. This plateau is made up of flat-topped mountains that dip sharply into valleys below. Elevations in the area may be as high as 800 ft (243 m) above sea level. Lookout Mountain, located in the southern section of the plateau, is named for the view that it provides of seven states. The Highland Rim, which is made up of an elevated plain with rounded hills known as knobs, lies to the west of the Appalachian Basin. The northernmost section of the Highland Rim is known as the Pennyroyal Region. The Highland Rim surrounds the Nashville Basin, which comprises the fertile farming area of Tennessee. The soils of the Highland Rim, however, are sandy and ill suited for farming.

Most of Tennessee is located within the Gulf Coastal Plain, which extends west from the Highland Rim and Nashville Basin. The section is only part of the greater Gulf Coastal Plain that begins at the Gulf of Mexico and continues into southern ILLINOIS. Tennessee's section of the Gulf Coastal Plain is divided into three sections, stretching eastward from the Tennessee River and westward toward the Mississippi River. In the east, a short stretch of hilly land follows the banks of the Tennessee River. In the west, the land is comprised of rolling hills and streams that traverse the area from Memphis into the western part of Tennessee



known as the Tennessee Bottoms. This bottomland has steep bluffs that overlook the Mississippi River. Lowlands, FLOODPLAINS, and swamps fill the final area of Tennessee's section of the Gulf Coastal Plain, which is known as the Mississippi Alluvial Plain or The Delta, rising no more than 300 ft (90 m) above sea level.

Around 50 percent of Tennessee's land is covered with forests that contain at least 150 species of trees, including ash, beech, elm, chestnut, maple, tulip poplar (the state tree), walnut, cedar, fir, pine, and spruce. Flowering trees include azalea, dogwood, mountain laurel, iris (the state flower), redbud, and rhododendron. Tennessee's wildlife includes black bear, white-tailed deer, opossum, fox, rabbit, skunk, and squirrel. Songbirds found in the state include bluebird, crow, ruffed grouse, hawk, mockingbird (the state bird), robin, and wild turkey. Migrating birds are common along the Mississippi River.

Agriculture dominated the economy of Tennessee until the 20th century, when the service and manufacture of new products began to generate a greater portion of Tennessee's income. Governmental jobs, such as those connected with the nuclear power research and development unit at Oakridge, also stimulate Tennessee's economy. Tennessee's most important minerals include bituminous coal, phosphate rock, gemstones, limestone, marble, zinc, sand and gravel, copper, clay, pyrite, and petroleum. Tennessee's top agricultural products are soybeans, tobacco, hay, cotton, corn, and wheat. The state's major industries include chemicals, textiles, apparel, electrical products, furniture, leather goods, food processing, and lumber. Tennessee is also a major producer of dairy and nursery product. Tourism is essential to Tennessee's economy.

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## territoriality

THE CENTRAL FOCUS of POLITICAL GEOGRAPHY is best understood from the point of view of the twin concepts of territory and territoriality. Neither of these can be understood apart from each other. In order to

talk of territory, one must talk of territoriality and vice versa. The word has possible roots in the Latin *terratorium* meaning "earth," and *terrere*, meaning "to frighten." As such, we can think of *territorium* as signifying a space from which people are warned off. References to *territory* as an administrative term occurred in the 15th century when it was used to refer to the land of a ruler and to the political HINTERLAND of cities. By the 17th century, usage expanded to include regions with undefined boundaries. This usage continued into the American experience with the conception of non-self-governing territories under the control of a central government. What joins all of these uses is the sense of territories as spaces that are categorized, mapped, and controlled. Using this perspective as a foundation, it is possible to define territory as a general term describing areas of land or sea over which states or other political entities claim to exercise some form of control.

There are many definitions of the concept of territory. Seen from the eyes of a city planner, a territory is an area that is subject to zoning in the planning process. From a political angle, it is that extension of land that forms a political district or belongs to an institutional organization (city, parish, province, region, nation, state). In each case, the reply to the question must consider a number of geophysical factors that impose clear limits to its dimensions. Islands, peninsulas, the lack of water creating a desert area, huge rivers, tall mountains, etc., play important roles in both dividing and defining areas. In other cases, history gives a meaning to a territory without the existence of visible borders.

In other situations, institutional divisions may be critical in establishing limits to an area even if done so artificially. And in others still, economic factors (central market, single-crop economies, raw materials), social factors (a specific community organization), political factors (one capital city, location of administrative centers) and cultural factors (a different language, own customs) may have been at work individually or collectively in establishing the limits to territories. Generally speaking, it is the combination of several or all of these factors that bestows a certain personality on a territory and differentiates it from its neighbors; it becomes a place.

Although a territory can thus be defined and demarcated as a place, it is important to remember that territories can and do change. First, a territory is not a fixed data point and is constantly undergoing changes, including changes that take place with its boundaries. Second, because its inhabitants use it, they give it a

specific personality that evolves over time and is reflected historically. And third, although there are common features that are identifiable throughout, they generally become blurred the farther they are away from the core.

The term *territorial*, on the other hand, is of more recent development and implies a much stronger behavioral connection between control and space. Territorial behavior, or territoriality, requires territory to be definitively bounded and exclusive. It is this understanding of territoriality as a strategic undertaking that parallels the emphasis on exclusive and monopolistic control over territory in conventional understandings of state sovereignty. From this perspective, we can define territoriality as an attempt by an individual or group to influence or establish control over a clearly demarcated territory.

### DEFENSE OF TERRITORY

Territoriality is action based, with designs to exercise control over some territory expressed as defense, control, exclusion, and inclusion. This means that in addition to territory having associations of area and boundary, it also has ones of defense. Territories are spaces that people defend by excluding some activities and by including those that will enhance more precisely what it is in the territory they want to defend. It is activity aimed at influencing the content and value of an area and, in doing so, creating a sense of place or community that is distinct from other areas. This means that people, firms, and organizations may be very dependent on what happens in the area they happen to be located in. If values are to be maintained, let alone increase, territorial strategies have to be deployed: attempts to structure movements into the area.

Territoriality is rooted in this contradiction between movement as a natural feature of human existence and fixity as a natural feeling of belonging and permanence. In order to carry on their various activities, people seek some fixation in their lives. They settle in particular places and over time become embedded in them either by making some type of relatively permanent transformation to the immediate environment or by developing relations with other people: relations of kinship, friendship, cooperation. But there are wider movements, which either underpin or threaten these place-bound activities.

To protect the place-bound relations that they have created, therefore, people in particular areas seek to control the movements in and out of them by defending, excluding, and including; in short, by exercising

their power to regulate this wider set of movements for local advantage. Rooting territoriality in the contradiction of fixity and movement helps to clearly identify what territoriality is ultimately about: maintaining a relation to the material environment that will facilitate the realization of human wants and needs, ideas whose basic foundation is institutionally defined through social, cultural, and economic activity.

Over time, many of the movements that affect our daily lives have changed in at least two senses. Because of advances in science and technology, they have tended to extend their geographic reach. That is, distance per unit of time has decreased significantly over the past 200 years. This same technological revolution has also made it possible for greater numbers of people and things to move, creating an incredible increase in magnitude. This increasing distance over which people carry out their life's functions, the increasing magnitude of geographic reach, is apparent at all geographical scales. It has also led to the current interest in globalization with a focus on the growth of worldwide trade and the movements of people in search of jobs. In terms of political geography, there has been territorial integration and there have been tendencies also toward disintegration.

### TERRITORIAL FRAGMENTATION

On the one hand, we can point to the extension of jurisdictional boundaries, the emergence of new territorial structures at larger scales, which come into being in order to facilitate movement and the advantages it can bring, e.g., the EUROPEAN UNION (EU), the NORTH AMERICAN FREE TRADE AGREEMENT, or NAFTA, and the Asia Pacific Economic Cooperation (APEC), to name just a few.

The justification for this sort of integration has been the classic free trade argument: that it would induce increased competition, heightened specialization, and therefore increased efficiency, and lower prices, adding to greater overall prosperity. At the same time, there have been disintegrating effects. Decolonization and the breakup of the Belgian, British, Dutch, French, and Portuguese empires produced a massive increase in the number of individual states during the period from about 1950 to 1980, particularly in Africa. And since the ending of the Cold War, there has been another burst of territorial fragmentation, the most obvious of which has been the breakup of the Soviet Union.

Territorial strategies, whether part of the natural biological world of plants and animals or the social representation of the human world, are always exer-

cises of power. The notion of power, on the other hand, is closely bound up today with that of the state. For in the contemporary world the state is quite possibly the most important regulatory agent. This is not to say that it has been a universal throughout human existence. There have been stateless societies. But there have been no societies that lacked means of regulating their activities. But what is attractive about the state as a means of regulating space relations, as a vehicle for the various exclusionary and inclusionary policies, is the territorial character of the state itself.

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## Texas

TEXAS IS A SOUTHWESTERN state of the UNITED STATES, bordering LOUISIANA, OKLAHOMA, and NEW MEXICO. MEXICO lies across the RIO GRANDE to the south. Texas also has a 350-mi (560-km) coastline along the Gulf of Mexico. Texas now ranks second among the states in both area and population. With a total area of 268,581 square mi (695,622 square km), Texas is second in size to ALASKA. Texas remains, however, by far the largest of the 48 contiguous states. The state's highest point is Guadalupe Peak, which rises to 8,749 ft (2,667 m) in the Guadalupe Mountains of far-west Texas.

With an estimated 2003 population of 21,779,893, Texas has surpassed NEW YORK to become second in population only to CALIFORNIA. Texas's population is 12 percent African American and 33 percent Hispanic. The state's capital is Austin. Houston, with a 2000 census population of 1,953,631, is Texas's largest city, followed by Dallas (1,188,580) and San Antonio (1,144,646). Major industries include long-established

petroleum and natural gas drilling and refining industries, as well as a large number of recently established high technology firms. Agricultural products remain vital to the economy; cotton, wheat, sorghum, pecans, and citrus are among the most important crops. The rearing of beef cattle—extremely important for the cowboy image that Texas continues to project to the world—is still an important industry.

Texas is big. In fact, its bigness largely defines the way Texans, and also the country and the world at large, think about Texas. It is roughly 800 mi (1,290 km) across Texas in both east-west and north-south directions. Because of the state's size, the landscapes of Texas are quite varied, ranging from sandy subtropical beaches along the southern gulf coast to mile-high mountains and arid deserts in the far west. Except for the mountains in the west, Texas has a tendency to be flat. A wide coastal plain extends inland from the gulf. Elevation gradually increases westward from the coast until the Balcones Escarpment is reached. This rather abrupt escarpment rises 300 to 500 ft (90 to 150 m) just west of a line connecting Waco, Austin, and San Antonio. To the west lies the rolling Edwards Plateau, the southernmost extension of the Great Plains. At its northern end the Edwards Plateau becomes the rather featureless Llano Estacado, which extends north into the Texas Panhandle. Elevations in the Edwards Plateau and the Llano Estacado range from 700 ft (210 m) in the south to over 1,200 ft (365 m) in the north.

Beyond the Edwards Plateau and west of the Pecos River, the mountainous part of Texas begins. This region includes a number of distinct mountain ranges, including the Guadalupe and Chisos mountains, as well as deep canyons cut by the Rio Grande. Texas's climate is as varied as its size. On the same winter's day it can be 90 degrees F (32 degrees C) at the mouth of the Rio Grande while a blizzard is raging in the Texas Panhandle. The natural vegetation cover of Texas includes pine forests in eastern Texas, mesquite-covered scrublands in southern Texas, extensive grasslands in northwestern Texas, and the yuccas and cacti of the Chihuahuan Desert within the "big bend" of the Rio Grande.

The oversized land of Texas has given rise to a population proud of its state, even to the point of bravado. Texas was the only state to become a state directly from a previous status as an internationally recognized independent state. Texas (its nickname "Lone Star State," is a remembrance of its once independent status) joined the nation as a consequence of an agreement between equals. Texas had been lightly populated

by native American tribes, although groups such as the Comanche left their mark on the lore of the state. Texas had been a part of the Spanish kingdom of New Spain and after the 1820s formed part of the newly proclaimed independent state of Mexico, although the Spanish-speaking population had always been small.

### THE ALAMO

In 1821, the Mexican government authorized a colony (300 families) of English-speaking Americans to settle in Texas. This colony, established by Moses and Stephen Austin, eventually grew in size and was joined by other groups, mostly from the southern United States. These American settlers soon clashed with the central Mexican government over many issues, notably self-governance for the area and whether slavery—which many of the American settlers depended on—should be allowed. In 1836 these settlers, after a brief revolution highlighted by the famous siege of the Alamo, established the Republic of Texas. This republic survived as an independent state until 1845, when the United States finally allowed Texas to join the union—as a slave state.

The admission of Texas to the United States led to the Mexican War (1846–48), two major consequences of which were the American conquest of New Mexico and California and the extension of the boundaries of Texas west to El Paso. Texas avoided most of the military action of the Civil War, and slavery was abolished in 1865. Texas's population and economy grew rapidly throughout the 20th century, thanks largely to the exploitation of immense natural reserves of petroleum. Texas's political power within the United States mushroomed as well. Of the 11 U.S. presidents who served in the decades following World War II, four had Texas roots: Dwight Eisenhower and Lyndon Johnson were born in Texas, while George H.W. Bush and George W. Bush, although born elsewhere, built their careers in Texas politics.

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## Thailand

**Map Page** 1124 **Area** 319,385 square mi (514,000 square km) **Population** 64,265,276 **Capital** Bangkok **Highest Point** 8,451 ft (2,576 m) **Lowest Point** 0 m **GDP per capita** \$1,874 **Primary Natural Resources** tin, rubber, natural gas, tungsten, timber.



THE KINGDOM OF Thailand, a Southeast Asian country, is bordered by MYANMAR (Burma) to the west, LAOS to the north and northeast, and CAMBODIA to the southeast. To the south lies the Gulf of Siam, where oil is drilled, and to the southwest is the Andaman Sea, a part of the BAY OF BENGAL.

Thailand's Mon kingdom of the early Christian era was overpowered by the Mekong delta-based Funan kingdom by the 6th century, but the Mons regained their power by 550. The Mons and all the later Thai kingdoms were based in the Chao Phraya river (main river of the country) valley and delta. Thailand became a vassal of Cambodia-based Angkor kingdom between 1223 and 1322.

Thereafter, the Thai kingdom of Ayutthaya (1350–1767) emerged, which moved its capital to Thonburi and then to Bangkok in 1782, both located by the side of Chao Phraya River. Thailand is the only country in Southeast Asia that has not been colonized by any Western power. Western modernization was welcomed by the king by the late 19th century with (a) construction of roads/railroads and telegraph services, (b) introduction of scientific education, and (c) abolition of slavery.

Today, Thailand has 2,448 mi (3,940 km) of railroads and 27,674 mi (44,534 km) of roads. Its wet-dry monsoon climate, with rains in the summer and temperature highs of 100 degrees F (37.8 degrees C), allows wet-rice cultivation, particularly in the delta, which, being in the rain-shadow, receives inadequate rainfall and therefore has developed a network of irrigation canals dating from several centuries ago. Irrigation and the large-scale introduction of a hybrid-seed-based green revolution since the 1970s have turned Thailand into a leading rice surplus and rice-exporting country; 54 percent of the Thai labor force is engaged in agriculture.

Thailand's forests are known for timber, particularly teak, but overcutting forced the government to



ban timbering in 1988. A replanting program has been started. Apart from some petroleum, rubies and sapphires are found in the country. It is the second- and third-largest world producer of tungsten and tin, respectively. Thailand's free market economy is friendly to foreign investment. Many transnational companies have established factories in Thailand, taking advantage of cheap labor. Exports also include computers and electrical appliances. During the 1985–95 period, the country registered its highest growth rate, about 9 percent annually. After a downturn as a result of increased speculative pressure in the Thai currency in 1997, the economy has started to revive with a gross domestic product growth rate of 5.2 percent in 2002.

The population of Thailand is growing at a slow rate of 0.95 percent (2003); four-fifths live in rural areas. Bangkok has been given a designation of “sex capital of the world,” as tourists visit the city to be served by sex workers. In the process, an increasing number of local people in Thailand get infected by and die of AIDS. In 2001, 670,000 people were living with HIV/AIDS virus with prevalence rate of 1.8 percent.

Thailand's major language is Thai; English is the secondary language of the elite. Theravada Buddhists are 95 percent of the total population. Thai (75 percent) and Chinese (14 percent) are the major ethnic groups. There is a thriving China Town in the capital of Bangkok, which is a primate city of 10.3 million (2000). The area around the capital is the most densely populated in the country. Bangkok sets the political leadership and standard of behavior for the rest of the country.

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## Thar Desert

THE THAR DESERT, often called the Indian Desert, extends for about 400 mi (644 km) from southwest to



*A Buddha statue in Bangkok, Thailand, epitomizes the strength of Buddhism in the country's cultural geography.*

northeast and has a maximum width of about 225 mi (362 km). The desert is limited to the south by the Great Rann of Cutch. To the west lies the valley-plain of the INDUS RIVER and to the northwest that of the Sutlej. Northwestward the desert fades into the Punjab state of INDIA, and the Aravalli range marks the southern limit. The greater part of the desert lies in the Indian state of Rajasthan, of which it occupies nearly half. The remainder is in PAKISTAN, where the desert occupies a large part of the former princely state of Bahawalpur and the old province of Sindh.

The greater part of the desert surface is composed of sands, silts, and loesslike material, the finer-grained

making excellent soil where water is available. The name Thar (desert or sandy waste) refers to the sand hills accumulated by the prevailing winds. Saline dust is transported from the Indus delta and the Rann of Cutch and deposited in hillocks. In the southwest, long ridges (in local Sindhi language, *bhits*) are found aligned from southwest to northeast parallel to the prevailing winds. In the northeast, these give place to transverse dunes of barchan type, though they are somewhat irregular. Toward the Rann, dunes more or less permanent may rise to 200 ft (76 m) above the general sandy surface; inland they are smaller.

The average rainfall in the area is 15 in (38.1 cm) a year and on the western margins near the Indus this drops to less than 5 in (12.7 cm). Temperature varies from 55 degree F (13 degrees C) to -70 degree F (-21 degrees C) in the cold season and from 90 degrees F (32 degrees C) up to 127 degrees F (53 degree C) in the warm season. Dust storms are common at the periods of reversal of pressure, about April to May and during October.

Surface deposits everywhere are impregnated with salt derived from the evaporation of subsoil brine and the accumulation of salt particles blown from the Rann. On the eastern margins of the desert are the Rajasthan salt lakes. Lake Sambhar, the largest, lies in a closed depression in the Aravalli schists with a surface at 1,184 ft (361 m).

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## third world

THE TERM *third world* is said to have been coined by demographer Alfred Sauvy in a 1952 article in the French magazine *L'Observateur*, which he ended by comparing the underdeveloped nations of the world to the peasants who led the French Revolution: "this ignored Third World, exploited, scorned." Some say French President Charles de Gaulle first used it; however, Sauvy's article is generally cited as the first docu-

mented usage. It began to be generally used after a 1955 conference of developing nations at Bandung, INDONESIA. A year later, a group of French social scientists published a book, *Le Tiers-Monde* (*The Third World*), and in 1959, economist Francois Perroux began publishing a journal of the same name examining problems of economically underdeveloped countries.

Sauvy explained that in coining the phrase, he was making an analogy to the peasants of prerevolutionary FRANCE, who were called the third estate and were scorned by the ruling classes—nobility being the first estate and the French church the second estate. Sauvy wrote that third world countries are considered insignificant and worth "nothing," although such countries "want to be something."

Are there first or second worlds? When Sauvy coined the term, World War II had just ended and the world had split into two large blocs of contrary views. On one side were the democratic-industrial countries within the American and Western sphere of influence. On the other were the Eastern bloc of communist-socialist states. The remaining majority of the world's states were not aligned with either group.

Thus, the first world was the leading industrialized nations, including what became the Group of Seven (G7) major powers: the UNITED KINGDOM, France, GERMANY, ITALY, JAPAN, CANADA, and the UNITED STATES. The second world was made up of the Soviet Union and the eastern Europe Warsaw Pact nations. But with the close of the Cold War, the differences between the two worlds became less distinct, particularly with Russia joining G7 and causing it to become the Group of Eight, and with former communist nations joining the NORTH ATLANTIC TREATY ORGANIZATION (NATO) and the EUROPEAN UNION.

Indeed, with the new economic power of the European Union, the riches of the oil-producing states and the ambitions of the emerging Pacific Rim nations, the original worldwide alignment has changed significantly. How, then, should such industrialized and increasingly prosperous and emerging nations as South KOREA, TAIWAN, SINGAPORE, and MALAYSIA be classified? What about the tiny oil-rich emirates of the PERSIAN GULF? Does their vast wealth put them in the first world? Or does their dependence on the industrialized world leave them in the maligned category of the third world?

Following is a list of the nations of the first, second, and third worlds as tabulated by the Nations Online Project in 2004:

## THE FIRST WORLD

(Nations within NATO and/or the European Union or their spheres of influence) ANDORRA; AUSTRALIA; AUSTRIA; BELGIUM; Canada; CYPRUS; DENMARK; FINLAND; France; Germany; GREECE; Holy See (VATICAN CITY); HUNGARY; ICELAND; IRELAND; ISRAEL; Italy; Japan; LIECHTENSTEIN; LUXEMBOURG; MALTA; MONACO; NETHERLANDS; NEW ZEALAND; NORWAY; PORTUGAL; SPAIN; SWEDEN; SWITZERLAND; TURKEY; UNITED KINGDOM; and the United States.

## THE SECOND WORLD

ALBANIA; AZERBAIJAN; BELARUS; BOSNIA-HERZEGOVINA; BULGARIA; CHINA; CROATIA; CZECH REPUBLIC; ESTONIA; GEORGIA; Hungary; KAZAKHSTAN; KOREA (North); KYRGYZSTAN; LATVIA; LITHUANIA; MACEDONIA; MOLDOVA; MONGOLIA; POLAND; ROMANIA; RUSSIA; SERBIA AND MONTENEGRO; SLOVAKIA; SLOVENIA; TAJIKISTAN; TURKMENISTAN; UKRAINE; UZBEKISTAN; VIETNAM; and the former states of Yugoslavia.

## THE THIRD WORLD

AFGHANISTAN; ALGERIA; ANGOLA; ANTIGUA AND BARBUDA; ARGENTINA; AZERBAIJAN; BAHRAIN; BANGLADESH; BARBADOS; BELIZE; BENIN; BHUTAN; BOLIVIA; BOTSWANA; BRAZIL; BRUNEI; BURKINA FASO; Burma (MYANMAR); BURUNDI; CAMBODIA; CAMEROON; CAPE VERDE; CENTRAL AFRICAN REPUBLIC; CHAD; CHILE; China; COLOMBIA; COMOROS; CONGO (Brazzaville); CONGO (Kinshasa); COSTA RICA; CÔTE D'IVOIRE; CUBA; DJIBOUTI; DOMINICA; DOMINICAN REPUBLIC; EAST TIMOR; ECUADOR; EGYPT; EL SALVADOR; EQUATORIAL GUINEA; ERITREA; ETHIOPIA; FIJI; GABON; GAMBIA; GHANA; GRENADA; GUATEMALA; GUINEA; GUINEA-BISSAU; GUYANA; HAITI; HONDURAS; INDIA; Indonesia; IRAN; IRAQ; JAMAICA; JORDAN; KENYA; KIRIBATI; KOREA (North); KOREA (South); KUWAIT; LAOS; LEBANON; LESOTHO; LIBERIA; LIBYA; MADAGASCAR; MALAWI; Malaysia; MALDIVES; MALI; MAURITANIA; MAURITIUS; MEXICO; MICRONESIA; Mongolia; MOROCCO; MOZAMBIQUE; NAMIBIA; NAURU; NEPAL; NICARAGUA; NIGER; NIGERIA; OMAN; PAKISTAN; PALAU; PALESTINE; PANAMA; PAPUA NEW GUINEA; PARAGUAY; PERU; PHILIPPINES; QATAR; RWANDA; SAINT KITTS AND NEVIS; SAINT LUCIA; SAINT VINCENT AND THE GRENADINES; SAMOA; SAO TOME AND PRINCIPE; SAUDI ARABIA; SENEGAL; SEYCHELLES; SIERRA LEONE; Singapore; SOLOMON ISLANDS; SOMALIA; SOUTH AFRICA; SRI LANKA; SUDAN; SURINAME; SWAZILAND; SYRIA; Taiwan; TANZANIA; THAILAND; TIBET; TOGO; TONGA; TRINIDAD AND TOBAGO; TUNISIA; TUVALU; UGANDA; UNITED ARAB EMIRATES; URUGUAY; VANUATU; VENEZUELA; Vietnam; YEMEN; ZAMBIA; and ZIMBABWE.

A quick glance of the list finds that several countries appear twice. Hungary is classified as both first and second world. China, Mongolia, North Korea and Vietnam are listed under both second and third world. Some nations, such as tiny NIUE in the South Pacific, are omitted altogether.

What makes a nation third world? Despite ever-evolving definitions, the concept of the third world serves to identify countries that suffer from high infant mortality, low economic development, high levels of poverty, low utilization of natural resources, and heavy dependence on industrialized nations. These are the developing and technologically less advanced nations of Asia, Africa, Oceania, and Latin America. Third world nations tend to have economies dependent on the developed countries and are generally characterized as poor with unstable governments and having high rates of population growth, illiteracy, and disease. A key factor is the lack of a middle class—with impoverished millions in a vast lower economic class and a very small elite upper class controlling the country's wealth and resources. Most third world nations also have a very large foreign debt.

## THIRD WORLD FOREIGN DEBT

Trying to pay off large foreign debt has become a serious problem for many third world countries and causes great hardship for their people. Sub-Saharan Africa, for example, pays \$10 billion every year in debt service. That is about four times as much as the countries in the region spend on health care and education combined.

How did they get into such debt? At the end of the 1970s, many oil-exporting countries had large amounts of extra money. They put it into first world banks, which then loaned it to third world countries for big development projects. However, a rise in world interest rates, global recession, low commodity prices and other factors caused many countries to fall behind in their payments. Today, the amount of money owed by developing countries has increased dramatically since the early 1980's. These countries now owe money to commercial banks and also to organizations like the World Bank, the International Monetary Fund (IMF), and to first world governments. How does the debt keep growing? Because it is especially difficult for developing countries to repay. Most loans to the third world have to be repaid in hard currencies—stable currencies whose value does not change very much throughout the year. Developing countries have soft currencies that go down in value. Therefore, when the



value of a developing country's money goes down, its debt rises. Thus, it takes more of the country's own currency to pay back the same amount of hard currency. This makes it much more difficult for the country to repay its loans.

Refinancing then can occur with more money borrowed to pay off the earlier loans. In theory, this should help developing countries. However, the reality is that they are merely taking on new debt loads in order to service existing obligations. The result is that countries have gotten deeper and deeper into debt with organizations like the IMF that carry strict conditions with them, such as forcing debtor governments to make cuts in spending on health care, education and food subsidies. These cutbacks in social services make life even worse for needy people in the indebted countries.

### THIRD WORLD CLASSES

Throughout the third world, millions live in a vast lower economic class while an exclusive upper class elite controls the nation's resources and political power. Frequently absent is a significant middle class. This can be seen in the Central American nation of Guatemala, where the indigenous native population lives in poverty while "colonial families" descended from the Spanish *conquistadors* control vast tracts of farmland, the political infrastructure, and the banking system. Although Spain granted Guatemala independence in 1820, indigenous farmers still rent the land of their ancestors from the descendants of the colonists. On the positive side, a middle class is emerging.

That same trend is seen in China and India. Millions of citizens in India can now shop in malls, talk to each other on cell phones, and eat vegetarian fare at McDonald's. Millions increasingly have a level of wealth that is approaching the middle classes of the West in buying power. Such encouraging signs are rare elsewhere in the third world. No significant middle class is emerging in strife-torn nations such as Somalia, Zimbabwe, or Liberia. But the trend can certainly be observed in Argentina, Chile, and Brazil and throughout the emerging Pacific Rim nations, such as South Korea, Taiwan, Indonesia, Malaysia—and in Africa in Tunisia, Egypt, and Botswana.

### THIRD WORLD INSTABILITY

Throughout the third world, governmental instability is a common factor. Unpopular regimes are ousted by military coups, popular uprisings, public scandals and elections by populations weary of increasing poverty,

austerity, hardship, and unemployment. The instability and turnover in government have a variety of causes. Political and economic power can encourage corruption and nepotism. Cultural, language, and ethnic communities sometimes are artificially separated by national borders, prompting territorial challenges, local resentment, insurgencies, and secession. Territorial boundaries inherited from colonial periods cause disputes over access to the sea and to oil and other raw materials. Ruling ethnic, regional, or military groups hold a monopoly on power, denying effective democratic representation and prompting revolt.

A look at South America shows a variety of case studies of governmental instability. In the first world, citizens generally experience orderly, constitutional transitions of power. Not so in the third world. In Venezuela, a combination of revolts and military coups saw the fall of the elected government in 1994. The scene was the same in nearby Ecuador with the collapse of the governments of Abdala Bucaram in 1997 and Jamil Mahuad in 2000. In adjacent Peru, President Alberto Fujimori was driven from office in 2000. In neighboring Argentina, Presidents Carlos Menem and Fernando de la Rúa fell amid threats of a default on foreign loans. In Bolivia, Gonzalo Sanchez de Lozada was deposed by the military, and in Brazil, the national assembly impeached Fernando Collor de Melho. All of these national leaders left office amid economic crises, corruption accusations, and widespread public protests. Bucaram, Sanchez de Lozada, and Fujimori all had to seek refuge out of their native countries.

In 2000, Ecuadorian president Lucio Gutierrez led a group of disgruntled junior army officers and 5,000 Indian protesters in an uprising that drove the highly unpopular Mahuad from power in the midst of the country's worst economic crisis in decades, with 70 percent of the population in poverty and the national economy showing little sign of recovery.

Fujimori's rule in Peru ended with his fleeing the country amid a series of scandals and crises. He had been elected to office in 1990 as a prominent entrepreneur outsider. The nation was fascinated with the idea of a Spanish-speaking politician with an Asian heritage and ethnicity. However, he dissolved the national congress and implemented tough austerity measures cutting back the most basic public services. He was accused of authoritarian and draconian measures to enforce his will, corruption, and even charges that he used death squads to eliminate opponents. Amid street protests, he fled to his family's ancestral home, Japan, where he was put under virtual house arrest.



Traditionally wealthy Argentina saw a repeat of the same. President Carlos Menem ruled the country following International Monetary Fund-imposed austerity programs blamed for putting Argentina's economy into recession and near collapse. Street protests and general strikes drove his successor, Rúa, from office, and in a presidential election the nation faced the unprecedented situation of no candidate willing to step forward to take office. National morale was at rock bottom after years of military rule and repeated coups to depose politicians accused of incompetence and even of looting the national treasury. Under Rúa, poverty hit 60 percent, unemployment went up to 21.5 percent, inflation rendered the Argentine currency worthless, per capita income fell 18 percent in one year, and foreign debt appeared to be strangling the country's ability to recover, prompting highly public talk of an outright default as the struggling Argentine government threatened to make no more payments.

Such third world instability is not unique to South America. Off the eastern coast of Africa, the picturesque Comoros Islands have endured 18 coups and attempted coups since the nation received independence from France in 1975. Decades of such instability have left the islands desperately poor and unable to capitalize on picture-postcard beaches that could develop an economy-boosting tourist industry. A crisis in August 1997 began when the people of the island of Anjouan announced intentions to break away from the main federation, complaining of economic neglect by the government on the main island of Grand Comore. Their resentment was fueled by the relative prosperity of the nearby island of Mayotte, which is part of the Comoros island chain, but which opted in 1976 to remain part of France. Troops from Grande Comore landed on Anjouan's palm-fringed beaches to prevent its secession, only to be repelled by armed rebels. The Organization of African Unity attempted to mediate, but hopes were dashed when fighting broke out between rival separatist groups on Anjouan.

Nearby on the African continent, events can only be viewed with incredulity and despair. In Sierra Leone, rebels took revenge by cutting off civilians' arms and legs—and prohibiting doctors from practicing. In the Congo (Brazzaville), war seems to follow war; when parts of the capital had been overrun by armed militias for five years, the government ordered troublesome neighborhoods “cleaned up” with mortar and artillery fire. In Central Africa and Guinea-Bissau, fighting has been continuous for two years, despite numerous cease-fires and peacemaking efforts.

Somalia has no formal government, just alliances between local warlords. Armed civil strife seems a constant in Angola, the site of one of the worst East-West conflicts in the 1970s and 1980s, where millions of land mines remain on the countryside.

Mining resources, especially control of diamond mines, were a key motivation for the conflicts in Angola, the Democratic Republic of Congo, Liberia, and Sierra Leone. In Angola and Mozambique it was ivory, in Rwanda, drugs.

Ethnic hatred was also a factor in Rwanda where more than 500,000 members of the ethnic Tutsis were murdered in a months-long mass genocide perpetrated by rival Hutu citizens often armed only with machetes, led by government radio broadcasts calling for the nation to be cleansed of Tutsis. In that horror, religious places of worship were packed with desperate civilians believing traditional sanctuary would be respected. Instead, the holy sites saw grisly murder of hundreds of men, women, children, and elderly—which spread to neighboring Burundi, where another 200,000 died.

In Liberia, armed civil conflict and charges of government-backed criminal activities prompted activist Ellen Johnson Sirleaf at a 2002 international conference to describe her native land as a “dysfunctional, autocratic kleptocracy,” meaning a regime devoted to stealing. At that same conference, the U.S. Principal Deputy Assistant Secretary of State for African affairs, William M. Bellamy, remarked that in many ways the Liberian government resembled a gang more than a legitimate government. Sirleaf charged that running water and electricity could not be found in the capital. She said a crisis existed in the state of schools, hospitals, and other vital social services around the country, but not because of inadequate natural resources.

Instead, she accused her government of large discrepancies between the national budget and actual income from various revenue sources, such as timber harvested from the nation's RAINFORESTS. She charged that while exploitation of natural resources had dramatically increased, Liberia's national budget had shrunk since the early 1980s from about \$500 million to roughly \$70 million, an 85 percent decrease. Profits were being pocketed by corrupt government officials, she charged. Furthermore, she accused the government of using the breakdown of civil society and security as a tool to control the people in an effort to “create an environment of total fear and intimidation.”

However, it is noteworthy that 40 of Africa's 53 countries, as well as vast regions in the interior of war-torn countries, are peaceful. A dozen countries have

had a growth rate of at least 5 percent in the last few years. Between 1995 and 1997, per capita income increased significantly in over 30 of Africa's 53 countries. Mauritius and Tunisia are regarded as economic miracles.

### THIRD WORLD POVERTY

In his book *The Elusive Quest for Growth*, the World Bank's William Easterly documents how the West has sent \$1 trillion in foreign aid as grants, debt relief and concessionary loans to the third world since the 1960s. Despite the money, poverty has not been eradicated. Why not? How should we define third world poverty? Money income or consumption can be an imperfect measure of poverty or wealth. A rural third world family may have no cash but be considered wealthy because it has a large herd of cattle.

A South American gold miner working at a remote site may have an income five times that of what he has made in years past but may remain in poverty because of the exorbitant cost of living in the mining area. An employee receives a paycheck for 20 million palos, but remains in poverty since a loaf of bread cost 500,000 palos yesterday and will cost 2million palos by the end of the month because of runaway inflation.

Thus, possession of cash cannot be the only measure of poverty or wealth. And what is the worth of self-esteem or personal fulfillment? Albert Schweitzer, Mother Theresa, and Mohandas Gandhi gave up material possessions. But were they poor? In a need for statistics, governmental agencies want simple, universal measures, such as the international poverty line of \$1 per day. This is a convenient tool, but is it accurate? Most of the world's people do not use U.S. dollars to purchase what they need, and a dollar's worth of currency in one part of the world can buy more in another place. Because of exchange rates, \$5 might buy a steak dinner in Argentina that would cost \$25 across the border in Chile. The American dollar is not an international constant.

Also, basic goods are often more expensive in poor nations than they are in rich ones, while services tend to be much cheaper, since the wages of the people providing them are significantly lower. A jar of American maple syrup might be extravagantly expensive in the third world, about the same as a week's wages for a cook, a housekeeper, and a driver.

A statistician might assert that someone in possession of the cost of a jar of maple syrup in the third world has the same purchasing power as someone in possession of three service providers' weekly wages in

America. But the extremely poor, of course, do not purchase American maple syrup, nor the services of cleaners, drivers, or cooks.

So measurement of third world poverty is not simple. It is difficult to quantify life in which 10,000 people live in a capital city's municipal dump, competing for the right to sort through garbage. Such a scene is common throughout the third world. So are scenes of abandoned elderly living in cardboard boxes or abandoned display areas at the national zoo. Or a mother who has walked 30 miles across a desert with her sick child to a clinic that has no more of the out-of-date antibiotics that could cure her baby's pneumonia.

### THIRD WORLD POPULATION GROWTH

In 1980, the Earth's population was estimated at 4.4 billion, 72 percent of it in the third world. By the turn of the millennium, it had passed 6 billion, with 80 percent of it in the third world. Such growth pressures impede progress in improving living standards. However, the solutions are not simple. Religious, cultural and traditional factors impede imposition of such measures as birth control. Ethics and moral issues challenge such practices as forced sterilization or mandatory abortion. Some question the reality of "the population bomb" projections of the 1960s or the accuracy of the planet's estimated limits.

Population control has also had unexpected effects. In 32 countries containing 14 percent of world population, population growth has stopped—primarily in first world societies. In sharp contrast, Ethiopia's population of 62 million is projected to more than triple to 213 million in 2050. Pakistan will go from 148 million to 357 million, surpassing the U.S. population before 2050. Nigeria is projected to go from 122 million to 339 million, giving it more people in 2050 than there were in all of Africa in 1950. India is projected to add another 600 million by 2050, thus overtaking China as the most populous country.

Declining birth rates in developed nations have resulted in a shortage of labor in the first world, prompting large migrations from the third world. Europe is seeing a massive infusion of workers from the Islamic sphere of influence. The United States is grappling with dramatically new demographics as Spanish speakers from Latin America fill labor needs and constitute a new community larger than the historic African American minority.

Population growth is causing many third world countries to struggle with the simultaneous challenges of educating growing numbers of children, creating

jobs for swelling ranks of young job seekers, and dealing with the environmental effects of population growth, such as deforestation, soil erosion, and falling water tables. When a major new threat arises—such as AIDS or aquifer depletion—such third world governments have difficulty responding. Problems routinely managed in industrial societies become full-scale humanitarian crises in developing nations.

A study by the International Water Management Institute (IWMI) reports that in India, a country heavily dependent on irrigation, recent growth in food production and population has been based partly on the unsustainable use of water. Nationwide, withdrawals of underground water are at least double the rate of recharge, and water tables are falling by 3 to 9 ft (1 to 3 m) per year. IWMI authors estimate that as India's aquifers are depleted, its grain harvest could fall by as much as one-fifth.

In a country where food and population are precariously balanced and the population increases by 18 million people per year, such a huge drop in food output could create economic chaos.

### THIRD WORLD DISEASE

Throughout the third world, death rates are high and rising. In Africa, a major cause is the HIV/AIDS epidemic. While industrial countries have held HIV infection rates among their adult populations under 1 percent or less, a 1998 World Health Organization survey reported that in Zimbabwe, 26 percent of the adult population was HIV positive. In Botswana, it was a staggering 38 percent; Zambia, 20 percent; Namibia, 19 percent; and Swaziland, 18 percent.

The result will be that these societies will lose one fifth or more of their adult population within the next decade from AIDS alone. These adult deaths, the deaths of infants infected with the virus, and high mortality among the millions of AIDS orphans could bring population growth to a halt or even into decline. However, the loss is great in that the highest mortality rate is among adults, leaving large populations of children behind. In the southern African nation of Swaziland, one out of four 15- to 49-year-olds are infected with HIV. The expectation is that at least a third of all 15-year-olds will die of AIDS. With one in three pregnant women HIV-infected, it can be expected that one in 10 of all babies born will also be infected. The death of parents is also creating an orphan crisis of unprecedented proportions. Already, one in six Swazi children under 15 years of age have lost one or both parents, and it is estimated that this figure will rise to one in

three children. Traditionally, most orphans have been accommodated within the extended family network, usually by uncles, aunts, or grandparents. However, the scale of the current Swazi orphan crisis is stretching this traditional social safety net to the breaking point.

### THIRD WORLD ILLITERACY

The United Nations defines illiteracy as the inability to read and write a simple sentence in any language. Figures from 1998 show that 16 percent of the world's population is illiterate by the UN definition, as are 5 percent of all Americans. However, in the poverty-stricken central African nation of Burkina Faso, the figure is 73.4 percent of the population and 83.6 percent of the women. In Afghanistan, 64 percent of the country cannot read nor write—including 79 percent of the women. In Laos, the number is 47.2 percent and 61.9 percent for Laotian women. In eastern Africa's Somalia, 62.2 percent of the population is illiterate and 74.2 percent of the women. In general, the higher the literacy rate of a country, the lifespan increases for such simple reasons as the ability to read prescriptions or understand a physician's instructions.

### A THIRD WORLD SUCCESS STORY

Botswana is a LANDLOCKED country the size of TEXAS that borders Zimbabwe to the northeast and South Africa to the east and south. About 1.6 million people inhabit Botswana. Roughly 80 percent live along the fertile eastern border of the state, since 84 percent of Botswana is the arid KALAHARI DESERT.

That's just one of the third world problems facing Botswana. It also has the world's highest known rate of HIV/AIDS infection, with 38 percent of the population infected. But it also has one of Africa's most progressive and comprehensive programs for dealing with the disease and one of the highest literacy rates in Africa, 79.8 percent. More women (82.4 percent) read and write than men (76.9 percent).

The Botswanan government reflects the nation's demographics, with members of the Tswana ethnic group (79 percent of the population) dominating national leadership. Formerly the British protectorate of Bechuanaland, Botswana has enjoyed four decades of uninterrupted civilian leadership without any of the military coups found elsewhere in the third world. It also has one of the most dynamic economies in Africa. Botswanans enjoy a per capita income of about \$8,500 in U.S. dollars. To put that figure in perspective, Botswana's per capita income is approximately twice as high as the average emerging Pacific Rim nation's

per capita average. The average individual in Botswana enjoys an income approximately four times that of other sub-Saharan Africans. Nearly every measure of health and social well-being indicates significant improvement in the average Botswanan's living conditions since independence in 1966.

There is strong evidence that the people of Botswana are quite content with their government. Their levels of taxation are lower than the sub-Saharan African average, yet they have high levels of public expenditures for such things like education and roads. Of all its neighbors, Botswana has been the only nation free from serious political turmoil. Furthermore, it is not dependent on the International Monetary Fund or the World Bank.

Why is Botswana doing so well? An easy answer is that Botswana is rich in diamonds. However, such wealth has been a near curse in other nations where corruption has looted the nation's riches. Some would credit Botswana's nonracial domestic policies. This tolerant approach led to an extensive inflow of political refugees from both neighboring countries when post-colonial European-dominated governments gave way to African-dominated governments. "Expatriates" is a word used in Botswana to refer to the 7 percent of the country's residents who are not black Africans; they include Europeans, white South Africans, and Asians forced out of the countries of Zimbabwe, Uganda, and South Africa.

Is Botswana's welcoming of refugee whites the key to its prosperity? No, and neither is another easy answer—that Botswana was a British colony. So were Zimbabwe, South Africa, Nigeria, and Uganda, all of which have experienced significant turmoil. Many of the problems of sub-Saharan Africa can be summarized simply as government failure.

Far too many post-colonial regimes have evolved into corrupted predatory institutions victimizing their citizens rather than protective states benefiting all. The key would appear to be Botswana's strong precolonial institutions, which on a tribal level placed checks and balances on political elites. British colonialism had only a minimal effect and did not destroy the strongest tribal traditions and infrastructures of the people of Botswana.

## NONALIGNMENT

Is the term *third world* out of date? Some critics say the concept of a third world is outmoded and too general. Other terms are suggested, such as "southern non-industrialized countries," "underdeveloped countries,"

"undeveloped countries," "maldeveloped countries" or "emerging nations."

The 1955 Bandung conference was seen by many as the beginning of the political emergence of what have been called the nonaligned nations, those not allied with either the first or second worlds. Leading this movement were two nations whose systems were dramatically in contrast, India and mainland China. Both played a major role in promoting the Bandung conference and the nonaligned movement that followed. However, was China truly third world? Or was it second world—given its socialist-Marxist centralized economy? Or was it first world, given its adversarial stance toward the Soviet Union? Or was it third world with its widespread poverty and lack of industrial development? As one can see, even from the beginning, the boundaries were blurred.

Without question, one result of the Bandung conference was the idea that some nations should remain aloof from superpower struggle. Paradoxically, one of the nonaligned movement's most outspoken proponents, Cuba's Fidel Castro, was a client state of the second world and actively confrontational against the first world—putting his nonaligned status into question.

The first Conference of Nonaligned Heads of State, at which 25 countries were represented, was convened at Belgrade, Yugoslavia, in September 1961, largely through the initiative of Yugoslavian President Josip Tito. He had expressed concern that an accelerating arms race might result in war between the Soviet Union and the United States. Subsequent conferences involved ever-increasing participation by developing or "third world" countries. The 1964 Conference in Cairo, with 47 countries represented, featured widespread condemnation of Western colonialism and the retention of foreign military installations.

Another organization that emerged as a champion of the third world was the UN, which at first had been dominated by European countries and countries of European origin. Numerically, the third world dominates the world body today, although the true power of the UN is with the Security Council, which includes no third world nations as permanent members.

Today, the third world remains diverse culturally and economically. The oil-rich nations, such as Saudi Arabia, Kuwait, and Libya, and the newly emerged industrial states, such as Taiwan, South Korea, and Singapore, have little in common with desperately poor nations such as Haiti, Chad, and Afghanistan. What is being done to resolve the problems of the third world? The United Nations Conference on Trade and Devel-



opment held in New Delhi in 1971 suggested that one percent of the national income of industrialized countries should be devoted to aiding the third world. That figure has never been achieved. In 1972, in Santiago, Chile, a subsequent session set a goal of a 6 percent economic growth rate in the 1970s for the underdeveloped countries. This, too, was never approached.

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## Three Gorges

THE MOUNTAINS OF the Three Gorges (Qutang, Wu, and Xiling) are some of the most spectacular scenery in all of CHINA. Located in the middle section of the Yangzi River (CHANGJIANG) they have long been the object of countless paintings, photographs, and other representations. And now they are the site of the world's largest hydroelectric project.

The Yangzi is the world's third-longest river and the longest in China. Its irregular and meandering course across many eastern and central provinces of China ends after a journey of 3,915 mi (6,300 km) in the East China Sea. To most Chinese, it is the "long river" (the Changjiang). The Yangzi and its tributaries drain about 706,000 square mi (1,829,000 square km). The Yangtze rises in Qinghai Province at an elevation near 16,000 ft (4,880 m) above sea level. From its source in the Tanggula Mountains, it rapidly gathers a

huge volume of water. Because of its steep fall, its flow carries great quantities of silt to its mouth.

Since prehistoric times the Yangzi has been the home of a vast company of the Chinese people. The silt from floods has enriched fields in its lower reaches. On the other hand, great floods have caused catastrophes that have killed millions and made millions more homeless and destitute.

In order to institute flood control and to generate electricity, the government of the People's Republic of China is building the largest hydroelectric project in the world to date. The Three Gorges Dam is located at Sandouping in Hubei Province. It is scheduled for completion in 2009. It will impound a reservoir that will stretch upstream for 350 mi (563 km), creating a lake about size of Lake SUPERIOR or the country of SWEDEN. The hydroelectric plant being constructed at the dam will be capable of generating 22.4 megawatts of electricity when generating at the peak of the project's capacity.

The Three Gorges Dam project has been the subject of extensive studies by China since the 1950s. The proposal to build the dam generated a heated debate in the Chinese government that lasted for some time before the final decision to build the dam was made by the People's Congress. Ultimately the size and cost of the project delayed its beginning until 1994, when, despite enormous opposition, construction began. Ten years later two-thirds of the project had been completed. The remainder has been planned for completion in 2009.

The Three Gorges Dam will flood enormous areas. This has required the relocation of over 1.25 million people. Most of them went to other areas of China, especially to urban areas, because the newly formed lake will submerge millions of acres of bottomland. The cost of the relocation of this number of people has been borne by the government. However, critics claim that even this funding has not been enough nor well spent in many places.

Building the Three Gorges Dam required the removal of nearly 4.5 billion cubic ft (125 million cubic m) of earth and rock. To construct the 600-ft- (183-m-) tall dam required 918 million cubic ft (26 million cubic m) of concrete. Part of the construction included a five-level ship lock for vessels to transit between the lake and the bottom of the dam.

One of the benefits of the Three Gorges Dam is the enormous electrical output it will generate. The original plan was to install 26 700,000-kilowatt turbo-generators. However, an expansion plan was approved in

2003 that will add six turbo-generators through a connecting tunnel inside of an adjacent mountain. The expected peak electrical output when the project is finished is 22.40 megawatts. This will be a clean air resource for supplying China's energy growth.

Critics have denounced the project for its social and environmental costs. The critics claim that the cost-benefit ratio is too high to justify the project. Some have claimed that the very cost of the project, which rivals the construction of the Great Wall, will make the cost of the electricity generated by the project unaffordable.

Other critics have argued that the physical relocation and resulting social dislocation of over 1 million people entails enormous suffering and loss. Many of the people being moved to urban areas are rural peasants who will suffer adjustment problems. The government has claimed that its resettlement program is actually a poverty relief program that will greatly improve the lot of those affected.

Other critics have focused on the over 1,300 known archaeological, historical, and cultural sites that will be destroyed by the waters of the lake. However, many more sites have been discovered since the area has been very carefully surveyed in preparation of rising waters of the lake. In the Badong district, the number of new sites climbed from 44 to over 2,000. Critics fear that much will be lost.

To preserve this cultural heritage, the government has built a Three Gorges Museum to present the history of the area. In addition several Three Gorges Cultural Protection Centers will be built for housing the numerous archeological and cultural objects from the areas. The historic city of Dachang has also been moved from its old site to a new higher location.

Environmental concerns have been of keen interest to the Chinese government in planning for the Three Gorges Dam. The high volume of silt is a major concern because in a relatively short time it could silt in the lake and greatly reduce the hydroelectrical production. To prevent this, the project has special gates for flushing silt down stream. In addition, extensive re-forestation of the upper Yangzi's watershed along with soil erosion programs is seeking to greatly reduce the volume of eroded material in the river. However, this will not stop coastal erosion, which depends on silt.

Another environmental concern is water quality and the consequent decline of fish populations. To ensure that water quality remains high, a wastewater processing plant and new garbage disposal facilities are being constructed. Associated with this is a potentially

dangerous increase in diseases such as malaria and snail fever.

Another environmental concern is with the fish population. Experience at large dam projects around the world has shown that there is an inevitable decline in the reservoir fish populations. The possibility that some species will become extinct has been used by critics to oppose the dam. The fact is that the dam will prevent some species from returning to spawning beds. Efforts to address this problem have been of concern as part of the dam's greater plan.

An important consideration is the danger a future war poses. The dam would be an obvious target. Destruction of the dam would not only hurt electrical output, but would flood 200 million people downstream.

The Three Gorges project is now a part of the Chinese government's Great Western Development Strategy. The cost-benefit ratio for the success of the project suggests insufficient direct benefits; however, indirect benefits of enormous quantities of electrical power, of reforestation, of recreational facilities, of numerous museums and cultural sites available for tourism and other benefits may outweigh the considerable costs.

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## thunderstorms

THUNDERSTORMS ARE produced by cumulonimbus clouds and include thunder and lightning. They form when the troposphere is unstable or conditionally unstable for a large portion of its depth and may have tops of 40,000 to 50,000 ft (12,000 to 15,000 m) or higher. In addition, thunderstorms require a source of

atmospheric moisture and a “trigger”—a feature that initiates upward vertical motion in the atmosphere. Thunderstorms are built of units called cells. A mature cell contains an updraft and a downdraft. Single cell thunderstorms may be only 2 to 3 mi (a few km) across and multiple cell thunderstorms may be a few hundred miles across. Cells have one of two types of structures: ordinary cells and supercells. Multiple cell thunderstorms may contain cells of both types.

A thunderstorm with a single ordinary cell is known as an air mass thunderstorm. These storms are not known for producing severe weather but do so on occasion. An ordinary cell goes through a life cycle that consists of three stages. The first stage is called the cumulus stage and has only an updraft. Bubbles of warm air rise through the lower troposphere and liquid water condenses when their temperatures cool to their dew point. A cumulus cloud is present that has not grown large enough to produce precipitation that can fall through the updraft.

As the cumulus cloud grows taller, the hydrometeors grow larger and can begin to fall through the updraft. This precipitation drags surrounding air down with it. In addition, on the edge of the cloud, the liquid water mixes with unsaturated air. Some of the liquid water evaporates, cooling the air. This cooler air is negatively buoyant and encourages downward motion. Some precipitation in downward moving air leaving the cloud through its bottom will evaporate, further cooling the air in the downdraft. When the precipitation reaches the Earth’s surface, the storm enters its mature stage.

As the cool downdraft contacts the Earth’s surface, it spreads out away from the storm. Its leading edge forms a gust front or an outflow boundary. As the downdraft air moves away from the storm, it cuts off the rising bubbles of air that originally started the storm. When the downdraft has spread through the entire storm and no updraft is left, the storm enters the dissipating stage. The storm weakens and begins evaporating from the bottom up. This entire life cycle lasts 30 to 60 minutes.

The updraft of a supercell thunderstorm rotates. This characteristic distinguishes it from the ordinary cell thunderstorm. The rotation is not influenced by the Coriolis force and may go in either direction but cyclonic circulation is preferred in North America. The supercell forms in an environment with considerable vertical wind shear. The updraft and downdraft will tilt and twist as they move through the storm. The updraft and the downdraft remain separated so that the down-

draft does not cut off the updraft. Thus, a single supercell storm may last for several hours. The updraft is strong and precipitation does not have time to form within it.

### RADAR HOOK

The updraft of a supercell storm shows up as a weak echo region when observed by radar. The rotation of the updraft pulls some of the storm’s precipitation partially around it. This forms a feature known as a hook on the radar. The end of this hook is the most likely spot for a tornado to form. Supercell thunderstorms are frequently associated with severe weather.

Thunderstorms most commonly exist in groups of multiple cells. Large multicellular groups are known as mesoscale convective systems (MCS). Ordinary cell thunderstorms in a multicellular group still last only 30 to 60 minutes. But new thunderstorm cells are formed to replace the ones that dissipate so that the multicellular storm may last several hours and, on rare occasions, even days. Multicellular thunderstorms may also contain supercells as well as ordinary cell thunderstorms. Thus, it is not unusual for multicellular storms to produce severe weather. If these storms move slowly, they may produce very heavy precipitation and flash floods.

Multicellular storms take two different forms. In one, the cells are arranged in a line and the storm is known as a squall line. In the middle latitudes, the most typical place to find a squall line is in advance of a cold front. In the other, the storms are arranged in a somewhat circular configuration. Some storms with this configuration are known as mesoscale convective complexes. These storms are defined by specific criteria from infrared satellite images. In general, they are larger and longer-lasting storms. Both types of multicellular storms may occur in the tropics as well as the middle latitudes.

Electrical discharges known as lightning are what make a thunderstorm. There can be no thunder without lightning, but someone who hears thunder may not necessarily see the lightning that caused it. Since the lightning flash travels at the speed of light and thunder travels at the speed of sound, the observer can estimate the distance between himself or herself and the lightning stroke. The observer counts the seconds between seeing the lightning and hearing the thunder and divides by five to get miles (three to get kilometers).

Most lightning takes place within a cloud or between clouds and is commonly known as sheet lightning. Cloud to ground lightning can cause fires and

injure or kill people and animals. Precipitation amounts from thunderstorms range from very light to excessive. Amounts that are not excessive are generally beneficial. Lightning carries the potential for danger. Tornadoes, hail, and strong winds often cause serious damage and may cause deaths.

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## Tian Shan

TIAN SHAN, THE name that Chinese geographers have given to the “Heavenly Mountains,” can also be spelled T’ien-shan or Tien Shan. The Junggar Mongols who inhabit the area call this mountain range Tengri Uul or Tengri Agula. A frequent component in place names in western CHINA, *tengri* in Mongol has the same meaning as *tian* in Chinese: “sky” and “God.”

The Tian Shan bisect in its entirety XINJIANG, China’s westernmost province, since the mountains extend from the SILK ROAD oasis of Hami in the east to KAZAKHSTAN and KYRGYZSTAN in the west. The total length of the Tian Shan is about 1,500 mi (2,400 km); two-thirds of the range is within China. The JUNGGAR BASIN and the temperate Gurbantunggut desert lie north of the range, while the TARIM BASIN and the warmer Taklimakan desert lie south of the Tian Shan. Rising above both deserts, the Tian Shan forms a wet and green insular world covered with spruce forests. Alpine meadows and fertile GRASSLANDS support traditional pastoral nomadism in areas between 5,400 and 7,400 ft (1,800 and 2,800 m). The snow-clad Tian Shan feeds majors rivers that allow intensive agriculture, like the Ili, Aqsu, Tarim, and Konqi rivers.

From 1929 to 1930, the Sino-Swedish expedition to the northwestern provinces of China mapped the eastern and northern Tian Shan. Understanding the geological history of this part of Xinjiang was the major objective of the expedition. Soviet earth scientists

began surveying the western Tian Shan in the 1930s. They discovered the highest peak (24,406 ft or 7439 m) in 1943, and named it Pik Pobeda (“Victory Peak”). During the 1950s, geographers, hydrologists, glaciologists, and geomorphologists from the Soviet Union and the People’s Republic of China worked together. Concerns for seismic activities, deforestation, and water management eventually resulted in the detailed survey of the area.

Originally called “Dihua shi” (“the Progressive City”) in Chinese, Urumqi was founded in 1760 by the Qing dynasty (1644 to 1912). Beijing wanted to control the only road that connects the Tarim and Junggar basins through the Tian Shan. The walled city was located at 2,760 ft (920 m) on the northern piedmont of the range. In 1884, Urumqi became the capital of Xinjiang (“the New Frontier”) province, which was renamed the Xinjiang Uygur Autonomous region in 1956. The city is today a large metropolis as well as an industrial center. Since 1950, continuous immigration from inner China has displaced the Uygur native population.

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## Tibesti Massif

THE TIBESTI MASSIF is a giant triangular massif located in southern LIBYA and northern CHAD. It lifts abruptly out of the SAHARA DESERT and is visually impressive. The massif covers an area of over 38,610 square mi (100,000 square km); over 11,583 square mi (30,000 square km) of this area consists of volcanic rock. The Tibesti Massif is separated from the other Saharan massifs to the east and west by deep basins of sedimentary rock. The highest mountain in the Sahara Desert is part of the Tibesti Massif. It is an extinct volcano, reaching 11,205 ft (3,415 m) above sea level, called Emi Koussi. It sits in the center of the Tibesti Massif and the crater is 11.8 mi (19 km) wide and 3,937 ft (1,200 m) deep. Emi Koussi is one of several



stratovolcanos on Tibesti Massif and is almost perfectly intact, with many fine examples of fumaroles, or vapor vents.

Tibesti is only one of several massifs in the Sahara Desert. The largest massifs in the Sahara are Tibesti, Hoggar in southern ALGERIA, and Jebel Marra in western SUDAN. These massifs formed in the Mesozoic and Tertiary periods with major uplifting in the Earth's crust. Their formation continued through the Tertiary period and into the Quaternary period, with massive outpourings of lava and more uplifting. Only one of the volcanoes on Tibesti has shown any recent stirrings. The rest are considered extinct. Radiocarbon dating from the granite rocks of Tibesti Massif indicates that it was formed about 500 to 600 million years ago.

### LAKES AND RIVERS

Like most of the rest of the Saharan area, Tibesti once had a wetter climate with many lakes and rivers. About 12,000 years ago this cycle ended and the area is now parched and dry. The landscapes of the area consist mainly of massive rock formations and some sand. Where there was once water flowing off Emi Koussi and the Tibesti Massif, many sharp valleys formed, diverging in all directions.

During an expedition in 1907, Captain J. Tilho found within one of the Tibesti water holes a living crocodile, a survivor of the residual fauna of that wetter time. There are no such creatures existent today because of the climatic changes. With the change in climate and increase in winds, megagrooves formed around the base of the upland areas of Tibesti and aligned with the dominant northern winds. These grooves are up to 32.8 ft (10 m) deep, closely spaced, and parallel to each other. These megagrooves can actually be seen from space and are one of the most unusual landscapes on our planet.

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## Tibetan Plateau

LOCATED IN THE southern part of western CHINA, this huge (900,000 square mi or 2,500,000 square km wide) and mostly barren tableland represents one-fourth of the People's Republic of China (PRC). Chinese geographers, who have conventionally called it Qinghai-Xizang gaoyuan, have defined the plateau as the area above the 9,000 ft (3,000 m) contour line. Outside China, the Tibetan Plateau is better known under two different names, either "the Roof of the World," because its mean elevation is 15,000 ft (5,000 m) high, or "the Third Pole," because its climate is extremely severe and unpredictable.

High mountains surround the plateau: the HIMALAYA, Gangdise (or Transhimalaya), and Nyanqen-tanghla ranges in the south, and the Altun, Qilian, and Kunlun ranges in the north. Several of the mightiest rivers of Asia find their sources on the Tibetan Plateau. The INDUS (Senge Khahap) and Sutlej (Langchen Khahap) irrigate PAKISTAN. The Brahmaputra (Yarlung Tsangpo) flows to INDIA and BANGLADESH, and the Salween (Gyamo Ngulchu) goes to Burma (MYANMAR). The Mekong (Dzachu) crosses Yunnan, LAOS, CAMBODIA (Kampuchea), and southernmost VIETNAM. The CHANGJIANG or Yangzi River (Drichu) eventually reaches SHANGHAI, while the HUANG RIVER (Machu) enters the north China plain only a few hundred miles away from BEIJING.

Administratively, the Tibetan tableland includes all of Qinghai and Xizang, which are the two provinces that together with western Sichuan have formed the Tibetan realm. Tibet used to consist of Ngari U (capital: Lhasa), Tsang (capital: Shikatse), Kham, and Amdo. After its troops occupied the area in 1950, the central government of the PRC changed the provincial boundaries of the Tibetan Plateau. Beijing created the Tibet Autonomous Region (or Xizang zizhi qu) out of Ngari, U, and Tsang and reorganized Kham (or Kang) into the prefectures of Gyaltang, Dhartsendo, and Barkam in the Yunnan and Sichuan provinces. The prefecture of Tso went to the province of Gansu, and finally Amdo, with the prefectures of Chapcha and Repkong, became the province of Qinghai.

The total population on the plateau of Tibet numbers only 8 million today. This figure is increasing, but precise census data may not be reliable because the Chinese military, illegal migrants from China proper, and some Tibetans are not properly registered. Only pastoral nomads, miners, and convicts inhabit Changtang (or Chang Thang), the name for the desolate cen-

tral part of the plateau, where the yearly mean temperature is below the freezing point. Most villages and cities are located in the lower valleys on the southern and eastern edges of the plateau. Tibetan settlements can also be found around Xining (in Qinghai), north of Qinghai Lake (or Koko Nor), and in Tso prefecture (in Gansu). These areas have also important Han Chinese, Hui Muslim and Mongol inhabitants.

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## time zones

TIME ZONES ARE industrial humanity's way of dealing with the phenomenon of the sun illuminating a round, rotating Earth. While a person in CHICAGO, ILLINOIS, observes high noon, a person in LONDON, England, is observing sunset, a person in Honolulu, HAWAII, is observing sunrise, and a person in MUMBAI, INDIA, is using artificial light to illuminate the night.

So long as travel and communications were relatively slow and timekeeping devices were primitive and inaccurate, this phenomenon remained of purely academic interest. The first practical use of the difference between observed solar times in various areas was in open-ocean navigation. The determination of longitude (one's location east or west) was one of the great problems of the Age of Exploration. After John Harrison's 1735 invention of the chronometer, a very precise clock that kept time with only a minimum of gain or loss, navigation officers could determine longitude by measuring the difference between observed solar time and the reference time on the chronometer.

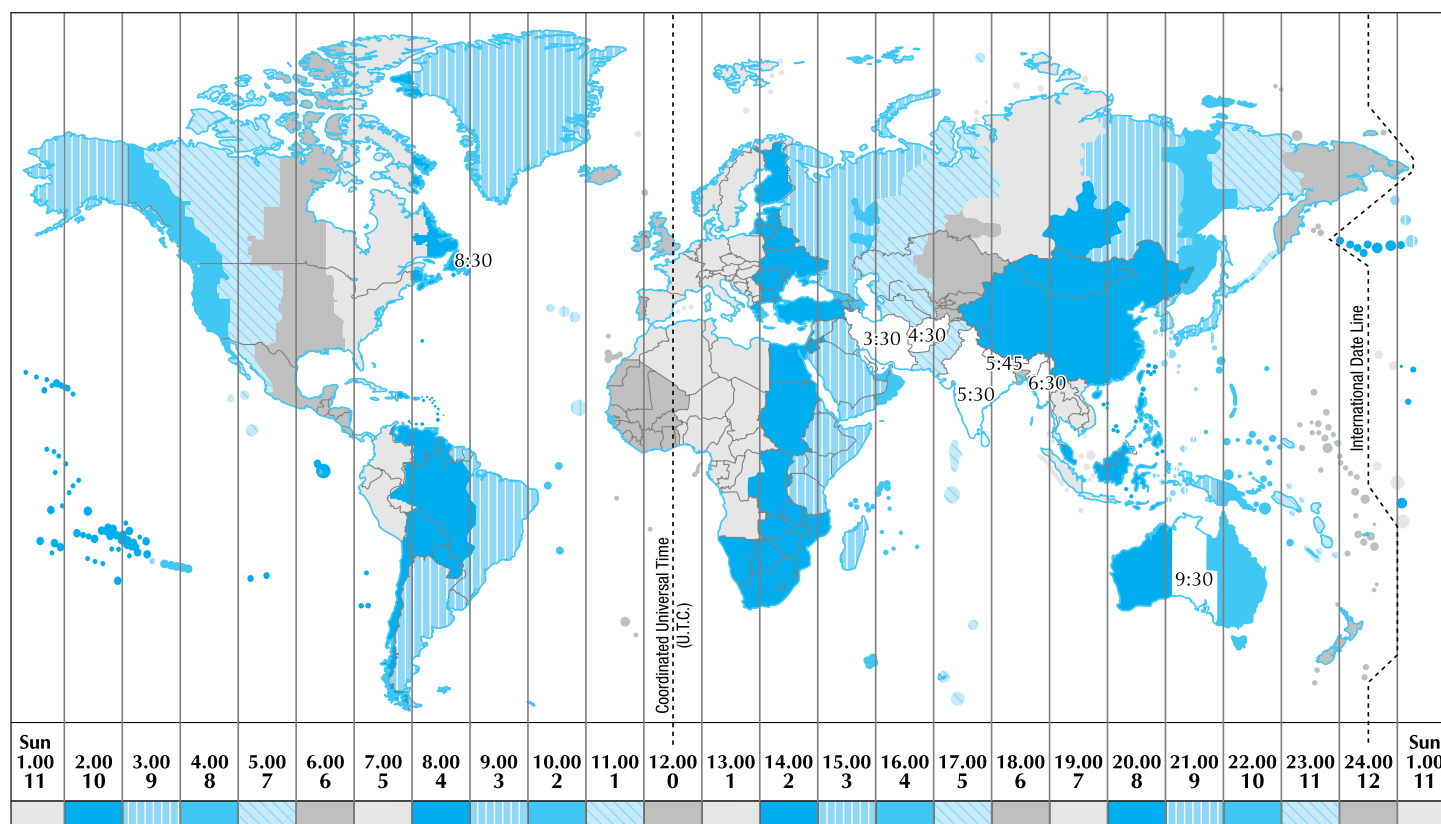
Although the use of sextant and chronometer to determine longitude became a critical skill for naval officers, it had little or no effect on the mass of society. All that changed in the 19th century, when the telegraph and the railroad enabled messages and people to outrace observed solar movement. Even a few minutes'

difference between the local solar times of origin and destination could throw schedules into a shambles. Some early English railways tried to coordinate their schedules by the use of an "official watch," which was carried aboard the train as a reference point. However, such solutions were only stopgaps, and the official time of the Greenwich Naval Observatory began to be transmitted throughout England by telegraph. Other European nations soon followed suit, using the solar time of their capital or national observatory as the nation's official time.

However, such a solution would not be practical for such a vast nation as the UNITED STATES. Under such a system, San Francisco's observed time would lag three hours behind official time from Washington D.C., leaving Bay Area residents rising in darkness and going to bed when several hours of daylight remained. As a result, American railroads proposed a system of multiple time zones, so that each region's standard time would remain reasonably close to observed solar time. However, while each railroad company established a common time along its routes to simplify schedules, this "railroad time" was not coordinated across the various railroad companies. Some major stations had to keep as many as 100 clocks in order to track the railroad time observed by all the companies whose trains used them.

In 1882, the heads of the various railroads met in St. Louis and worked out a system by which they divided the United States into four standard time zones. Each zone would be centered on a meridian of longitude 15 degrees apart—15 degrees multiplied by 24 hour-wide zones producing the full 360 degree circle of the Earth. This system went into effect the following year, although there were years of resistance before the system of standard time was accepted in all aspects of American society rather than being used merely as a system to rationalize train schedules. In one town, a man was fined for contempt of court when he failed to appear for a noon court date, because he persisted in using local solar time instead of standard time.

During 1917, at the Anglo-French Conference on Time-Keeping at Sea, it was recommended that all ships, both military and civilian, should adopt hourly standard time zones on the high seas. Whenever a ship was within the territorial waters of any nation it would use that nation's standard time. The captain was permitted to change his ship's clocks at a time of his choice following his ship's entry into another time zone—he often chose midnight. Standard time was not given the force of law until 1918, at which time the Interstate



As designated first in 1882, each time zone is centered on a meridian of longitude 15 degrees apart—15 degrees multiplied by 24 hour-wide zones produces the full 360-degree circle of the Earth.

Commerce Commission firmly established the boundaries of time zones within the United States.

In 1884, Congress passed a resolution authorizing President Chester A. Arthur to call an International Meridian Conference. This conference was held in Washington, D.C. and established standard time zones for all the world. Although the meeting was being held in America, the Greenwich meridian was chosen as the zero point for the time system, following the established practice in the English-speaking world of using that meridian as the zero meridian of longitude. This time zone was termed Greenwich Mean Time (GMT) or universal time. The conference then established 12 time zones on either side of the prime meridian, as well as the INTERNATIONAL DATE LINE in the PACIFIC OCEAN, at which point each day is considered to begin.

### ODD PATCHWORK

In actual practice, the system of time zones has become an odd patchwork, as various polities have pushed and pulled the boundaries of the time zones away from the ideal arrangement in order to avoid having communi-

ties cut in half. This patchwork has been further complicated by differences in the practice of observing daylight saving time in the summer, moving clocks an hour forward to better use the longer hours of daylight.

Daylight saving time has often been traced to a satirical proposal by Benjamin Franklin, who in fact was humorously urging his countrymen to rise earlier in the morning. The first practical daylight-saving proposal was put forth in 1907 by William Willett, but his considerable lobbying was unable to convince the British government to adopt it. Only during the fuel shortages of World War I was daylight saving time put into effect by several of the combatant nations, but it was so unpopular that all governments dropped it after the armistice.

The United States reinstated mandatory daylight saving time during World War II, but after the peace it left the decision to retain daylight saving time up to the individual states, except during the 1973 Arab oil embargo, when the federal government temporarily mandated an early beginning to daylight saving time for 1974 and 1975.

Several U.S. states do not observe daylight saving time at all. It has been an ongoing controversy in INDIANA, which straddles the actual boundary between the Eastern and Central time zones but in fact has adopted a unified time. Although the state has been considerably pressured to adopt daylight time, and a few counties adjacent to Chicago and Louisville follow the daylight-time observance of those respective cities, the main part of Indiana has steadfastly refused to adopt daylight saving time. ARIZONA also does not observe daylight saving time, except in several of the nominally sovereign Native American reservations.

A few countries do not observe standard time except as it relates to international travel and communication. For instance, life in SAUDI ARABIA is still governed by traditional Muslim religious rituals that must be held on the basis of observed local solar time, particularly in the sacred cities of Mecca and Medina. The People's Republic of CHINA uses a single time zone based upon what would be the standard time in BEIJING, resulting in times in the westernmost parts of China being three hours out of step with the environment, but since the bulk of the population lives on the eastern coast, the central government considers the resulting administrative unity more useful.

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## Titicaca, Lake

HIGH IN THE ANDES MOUNTAINS between BOLIVIA and PERU at 12,580 ft (3,810 m) above sea level, Lake Titicaca is said to be the highest fresh-water lake on Earth navigated by large vessels. Forty-one islands, some of them densely populated, rise from its shores. The lake covers 3,200 square mi (8,300 square km) and extends in a northwest-to-southeast direction for 120 mi (190

km). It is 50 mi (80 km) across at its widest point and divided at its narrowest point by Tiquina Strait. The southeast portion of the lake is called Lago Huinaymarca in Bolivia and Lago Pequeno in Peru. A larger section in the northwest is called Lago Chucuito on the Bolivian side and Lago Grande in Peru. Titicaca's depth averages between 460 to 600 ft (140 and 180 m) with the greatest recorded depth, 920 ft (280 m), in the northeast corner.

The origin and meaning of the name *Titicaca* is uncertain. Ruins along the lake include a temple on Titicaca Island marking the spot where, according to legend, the founders of the Inca Empire, Manco Capac and Mama Ocllo, emerged from the waters, sent to Earth by the sun. Legend also has it that when Spanish Conquistadors in search of gold reached Cuzco, the retreating Incas reportedly took a two-ton gold chain from the temple at Koricancha and threw it into Titicaca. Attempts to find it have been unfruitful although underwater ruins of an inundated, ancient city have been discovered.

### DISPUTED CLAIMS

Is Titicaca the largest lake in South America? VENEZUELA's Lake Maracaibo is larger at 5,100 square mi (13,210 square km). Is Titicaca the highest lake in the world and is another oft-repeated claim true that Titicaca is the highest navigable lake in the world? Lake Namtso in TIBET (15,479 ft or 4,718 m above sea level) is crossed daily by boats. Yamdrok in CHINA (14,570 ft or 4,441 m above sea level) is navigated by shepherds who ferry their flocks across its waters. Is Titicaca the highest freshwater lake in the world? More than 20 rivers flow in, but only the Desaguadero River drains at the lake's southern end. Most of the water is lost by evaporation. As a result, Titicaca's waters are slightly brackish, with salinity ranging from 5.2 to 5.5 parts per 1,000 and measurable quantities of sodium chloride, sodium sulfate, calcium sulfate, and magnesium sulfate.

In 1862 the first steamer to ply the lake was disassembled in England and carried on muleback up to the lake. Large vessels make regular crossings from Puno, Peru, to the Bolivian port of Guaqui. A narrow-gauge railway connects Guaqui with La Paz, Bolivia. The world's second-highest railway runs from Puno down to Arequipa, Peru, and the PACIFIC OCEAN.

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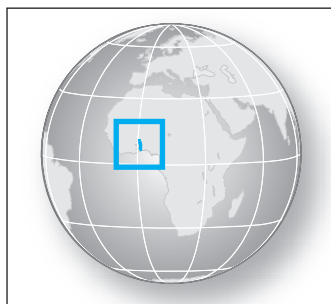


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## Togo

**Map Page** 1113 **Area** 35,284 square mi (56,785 square km) **Population** 5,429,299 **Capital** Lomé **Highest Point** 3,234 ft (966 m) **Lowest Point** 0 m **GDP per capita** \$1,500 **Primary Natural Resources** coffee, cocoa, cotton, yams, cassava (tapioca).



TOGO SITS ON the southern end of the western portion of Africa. This narrow strip of land has 35 mi (55 km) of beautiful coastline and rolling hills and plateaus in the interior sections. Deciduous forests cover much of the hills and portions of the land are suitable for growing coffee. Animals such as the hippo and giraffe wander through the land, and storks and cranes can be seen flying overhead. The rainy season lasts from April to July; the hottest period is from February to March. From December to January, the dry and dusty hamattan wind blows across the region.

From the 15th century to 1960, Togo was controlled by European powers. Initially discovered by Portuguese explorers and traders in the late 15th century, this territory became a key area in the African slave trade through the 18th century. DENMARK laid claim to the country in the 1700s, but GERMANY gained control of Togoland (as it was known) after signing a treaty with the local king, Mlapa, in 1884. Germany declared control of the coastal territory and slowly moved inland.

The Germans created infrastructure, and exported the cacao, coffee, and cotton. After Germany was defeated in World War I, the country became a League of Nations mandate and was subsequently split between the British and French. The British section of the country was named Togoland and the French section, Togo. After World War II, the entire territory became a United Nations mandate still ruled by the British and French.

In 1955, Togo became an autonomous nation, but still was part of the French union. A legislative assembly was created, and one year later, a constitution was approved. Nicholas Grunitzky became the first prime minister of the country. In 1957, British Togoland became part of the new nation of GHANA. By 1960, Togo had declared its independence with Sylvanus Olympio as president. Three years later, Olympio was assassinated in a military coup. Nicolas Grunitzky was placed in charge, but he was deposed in 1967 in a bloodless coup led by Colonel Étienne Eyadema.

In 1969, the Assembly of the Togolese People was created with Eyadema as the party president. He nationalized the foreign-owned phosphate mines. During the 1970s, Togo's economy prospered. However, when the worldwide recession hit in the early 1980s, phosphate prices dropped considerably, and Togo never fully recovered.

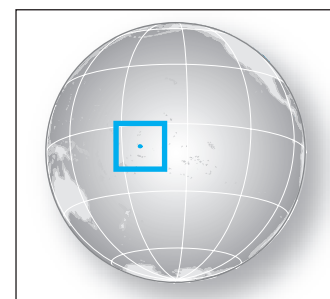
During the early 1990s, international leaders called on Eyadema to implement a multi-party political system in the country. Prodemocracy protest groups were formed, and citizens staged riots and strikes. Under internal and external pressure from international leaders, Eyadema stepped down from power in early 1993 and placed an interim prime minister in charge of the country. In August 1993, Eyadema won the presidential election by more than 96 percent. Throughout the 1990s and into the 2000s, Eyadema continued to rule through alleged corruption.

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## Tokelau

**Map Page** 1125 **Area** 3.86 square mi (10 square km) **Population** 1,418 (2004) **Capital** none **Highest Point** 16 ft (5 m) **Lowest Point** 0 m **GDP per capita** \$1,000 (estimate 1993) **Primary Natural Resources** copra, fisheries, craft goods.



A COUNTRY LOCATED in the South PACIFIC OCEAN halfway between HAWAII and NEW ZEALAND, Tokelau covers a huge area of ocean but only a tiny area of land. The total land area of the three atolls, Atafu, Nukunonu, and Fakaofu, is just 3.86 square mi (12 square km), with the largest atoll, Nukunonu, 1.81 square mi (4.7 square km) in size. The atolls are essentially each a reef-bound islet surrounding a lagoon. While the climate in the atolls is fairly constant and averages 82 degrees F (28 degrees C), the islands are often threatened by cyclones. The atolls are also under threat from rising sea levels.

The islands have been inhabited for approximately 1,000 years; the first Europeans visited in 1765. Catholic Samoans settled for a short while on the islands to convert the population to Western religions. In the mid-1800s, the population suffered greatly when Peruvian slave traders captured around 250 people and missionaries removed another 500. The islands were annexed by Britain in 1889 and the administration was handed over to New Zealand in 1925, where control has remained since.

The population of Tokelau is just under 1,500 and almost exclusively Polynesian. The languages spoken are Tokelauan and English. Traditional Polynesian culture systems still exist and land is controlled by chiefs and is passed down from generation to generation. Daily operations are organized by village leaders and family representatives, and traditional male and female work and family roles have been maintained. The only major influence that Western culture has had on the society is through religion, with almost 100 percent of the nation practicing either Roman Catholicism or Congregationalism. There are no guns on any of the islands, and alcohol is extremely limited.

Although each of the atolls has its own administrative center, the nation is ruled externally by New Zealand, which appoints an administrator to head the Office for Tokelau Affairs, based in New Zealand. The citizens are classed as citizens of New Zealand, and therefore have the right to migrate whenever they wish. In the 1970s, population growth was threatening the survival of the nation, and New Zealand began to offer incentives for people to migrate to New Zealand, and this has resulted in a community of around 3,000 Tokelauans now living in New Zealand. New Zealand also provides defense services for the country.

New Zealand contributes about 80 percent of the budget to support public administration, as well as community and infrastructure development and maintenance. The public service economic sector is the main

employer in the country, all administered from New Zealand.

Unlike many other South Pacific countries, tourism in Tokelau is little developed. Travel to the islands is difficult, as there is no airport and the anchorages can be quite unsafe. One ocean vessel does travel monthly from Samoa, but needs to dock at sea and visitors have to be transported to the islands by small boat.

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## Tokyo

THE CAPITAL OF JAPAN, Tokyo is one of the world's largest, most densely populated, and most influential cities, with a population of more than 12 million (2003). The Tokyo Metropolis (Tôkyô-to) has an area of 828 square mi (2,145 square km) and for administration purposes consists of 23 wards, 26 cities, 1 county, 4 island administrative units, and 15 towns and villages. Combining the metropolis with suburban areas in neighboring prefectures of Saitama, Kanagawa, and Chiba creates an urban agglomeration known as Greater Tokyo, which constitutes the world's largest such area, home to nearly 32 million, about a quarter of the population of Japan. The expanse of Greater Tokyo and its huge population makes the crowded average commute for workers in Tokyo more than 90 minutes each way.

Tokyo sits at the confluence of several rivers, facing Tokyo Bay. None of these rivers, including the Sumida, Tone, and Arakawa, are navigable very far upstream. Conversely, none have been the source of significant flooding. These modest rivers and streams have necessitated hundreds of bridges in Tokyo, including the central Nishinomiya, from which all distances in Japan were traditionally measured.

The eastern half of the central city constituted the old commercial downtown district (Shitamachi), while the western hills (Yamanote) were home to metropolitan Tokyo's more affluent residential areas. In the post-World War II period, large sections of Tokyo Bay were

filled and new sections of city built upon what was once water.

An extraordinarily complex web of public and private railway lines, subways, highways, and roads converge upon Tokyo, linking it to surrounding suburbs and the rest of the country. Nodes of rail transportation along the loop circling the city have developed into the major commercial districts of postwar Tokyo, notably Ikebukuro, Shinjuku, and Shibuya. The railway station at Shinjuku is the world's busiest. Since Tokyo Bay was silt-clogged and shallow, the natural port city of Yokohama, about 25 mi (40 km) to the south, grew as the region's shipping center. The two cities are today a continuous industrial urban conurbation of tremendous concentration, although the district between Tokyo and Yokohama is separately incorporated as the municipality of Kawasaki.

Tokyo emerged as a city relatively late in Japanese history, long after the cities of Osaka and Kyoto. It was only after the Tokugawa bakufu established its headquarters in what had been a sleepy fishing village in 1603 that Tokyo became a city. Soon Edo (as Tokyo was called until 1868) was the largest city in the land, and the first- or second-largest in the world, with a population exceeding 1 million by the 18th century.

Edo was the shogun's capital, home to the largest castle in the land, situated at the strategic point where the flat lands to the east began to rise westward. (Remnants of the walls and moats that protected the Edo castle from battles that never came can be found surrounding the Imperial Palace in the heart of today's Tokyo.)

Founder of the regime that bore his name, Tokugawa Ieyasu chose to make Edo his base. After Ieyasu's appointment as shogun in 1603, he began a series of policies that made Tokyo a huge city and spawned more than 200 nascent urban areas around the country, the "castle towns." (Today, there are 10 Japanese cities aside from Tokyo with a population of 1 million or more.)

Edo, along with other Japanese castle towns, grew into cities as a result of the alternate-attendance system (*sankin kôtai*). Semi-independent local rulers (*daimyô*) were compelled to spend half their time in Edo, and half in their castle seats. Thus did Edo become a city, home not only to the shogun and his government, but to fortified mansions of the more than 200 lords (*daimyô*) who pledged loyalty to him.

Because of this policy, about half of the population of Edo in the Tokugawa period (1600–1868) were samurai, much higher than in any of the castle towns,



*Though a world-class city today, Tokyo was also the largest (or second-largest) city in the world by the 18th century.*

where merchants ostensibly serving the samurai class quickly outnumbered them.

U.S. Commodore Matthew C. Perry ended Japan's isolation when he steamed into Tokyo Bay in 1853. Fifteen years later, the Meiji Restoration of 1868 inaugurated a new phase in Japanese history, pursuing rapid modernization on a western model. The young Meiji emperor moved from the ancient capital of Kyoto to Edo, which became the new capital of Japan, renamed Tokyo (Eastern Capital). The population of Tokyo grew rapidly from the late 19th century as the commercial and government heart of the land (which Tokyo remains to this day).

Tokyo was destroyed twice in the 20th century, first by the earthquake of 1923 and then by the fires of World War II. On September 1, 1923, the huge Kantô earthquake struck just before noon. Centered on Yokohama, the earthquake's destructiveness was mostly caused by fires, which quickly destroyed Tokyo's old downtown (*shitamachi*). Tokyo was rebuilt after the earthquake in a more modern guise, with ferroconcrete buildings instead of wooden two-story *shitamachi* shops and subways instead of streetcars.

By 1935 the population of Tokyo of more than 6 million was equivalent to those of NEW YORK or LONDON. Most of Tokyo was again destroyed by incendiary bombing in the last months of World War II. By the mid-1950s, as Japan entered its era of high-speed growth, Tokyo grew in wealth and population as never before.

The Tokyo Olympics of 1964 shone a world spotlight on the city, its new buildings, and the world's





The Tokyo Metropolis (Tôkyô-to) has an area of 828 square mi (2,145 square km) and for administration purposes consists of 23 wards, 26 cities, 1 county, 4 island administrative units, and 15 towns and villages.



fastest train, the “bullet train” (*shinkansen*), which began operating along with an expressway into Tokyo.

The high-speed growth years of the 1960s also posed significant problems for Tokyo, including overcrowding and industrial pollution. The air and water pollution of Tokyo was among the worst in the world. The city embarked on a campaign to pursue environmentally sound policies in the 1980s, though noise pollution and crowding remain a persistent problem in this vibrant metropolis. Tokyo remains the center of Japanese government, economic power, and cultural activities to a far greater degree than LONDON, NEW YORK CITY, or PARIS. It has also become a world center of culture, including in music and the arts.

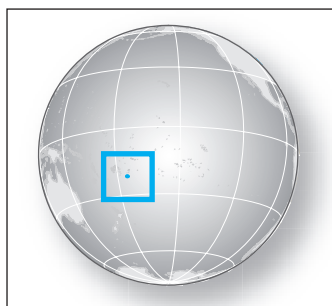
When Japan’s “bubble economy” burst in the 1990s, government leaders in Tokyo began to struggle with the challenge of much slower growth and a stubborn recession. An ironic symbol of the difficulty of finding new directions in Japanese politics came in 1991, when the Tokyo Metropolitan Government moved to a huge new 48-story headquarters in the Tokyo ward of Shinjuku. About 12,700 government employees work in this huge complex, capped by a 797 ft (243 m) skyscraper.

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## Tonga

**Map Page** 1125 **Area** 289 square mi (748 square km)  
**Capital** Nuku'alofa **Population** 108,141 **Highest Point** 3,409 ft (1,033 m) **Lowest Point** 0 m **GDP per capita** \$2,200 (2001) **Primary Natural Resources** fish, fertile soil.



THE KINGDOM OF TONGA is one of the few states in the south PACIFIC OCEAN to have retained its traditional monarchy and much of its traditional culture. King Taufa'ahau Tupou IV enjoys the popularity gained by his ancestors and holds considerable power in the national government, but there are pressures toward increased democratization of the islands, fueled by problems of overpopulation and traditional land-distribution practices.

Culturally and linguistically part of POLYNESIA, the name *Tonga* derives from the Polynesian word for “south.” The islands are located in the center of the south Pacific, just west of the INTERNATIONAL DATE LINE, east of FIJI, south of WALLIS AND FUTUNA and SAMOA, and west of NIUE. Its 171 islands spread over 273,000 square mi (700,000 square km), with a total coastline of 259 mi (419 km), are divided into three main groups, plus several smaller islands further to the north (the Niuas).

The Tongatapu Group includes the island of Tongatapu (“sacred Tonga”), with 35 percent of the land and most of the population. About 62 mi (100 km) to the north is the Ha'apai Group, consisting of very small islands and coral reefs, followed by the Vava'u Group another 62 mi (100 km) to the north. Most islands are raised limestone or coral overlaying a volcanic base, with few hills. Some of the islands are of volcanic origin, close to the geologically active undersea region of the Tonga Trench, with recent activity on Fonuafo'ou in the Ha'apai Group. The volcanic islands are very different from the others, with high cliffs and deep forests. One of these, 'Eua, southeast of Tongatapu, is becoming a chief attraction to tourists for its undeveloped RAINFORESTS, beaches, and caves.

### FRIENDLY ISLANDS

Known as the Friendly Islands by European explorers, the islands of Tonga were united under one chief in 1845. Struggles between traditionalists and the reform-minded royal family (converted to Christianity by Wesleyan missionaries) led to adoption of a constitution in 1875 that is still mainly in force but also led to abuses that brought British interference to the islands and the establishment of a protectorate in 1900. Queen Salote Tupou III (1918–65) was immensely popular and settled much of this discord.

Politically savvy, the queen kept Tonga's position as a proud Polynesian kingdom within the British Empire and introduced health services and education. But she also abrogated much of the rights and powers women had enjoyed in traditional Tongan society, a reflection



*The United States has the highest incidence of tornadoes in the world, but a similar geological combination exists in Bangladesh.*

of her upbringing in the Christian missions. Never having been fully administered as a colony, Tonga cut its official ties with the UNITED KINGDOM in 1970, but remains an active member of the Commonwealth.

Agriculture (mostly palm groves and coconuts) is the largest economic activity in Tonga, but it continues to depend on imports of much of its food from NEW ZEALAND. Tourism is also an important industry, but by far the largest revenue generator for Tonga is remittances from Tongans working overseas (as much as 40 percent of the gross domestic product in the mid 1980s). These problems are exacerbated by cyclone and earthquake activity, plus one of the densest popu-

lations in the Pacific. The old noble landowning classes are facing increased demands for a more equitable distribution of precious land resources, while many Tongans continue to flee to other countries to find work.

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## tornadoes

A TORNADO IS A RAPIDLY rotating column of air under a thundercloud. The term is believed to have come from the Spanish *tronada*, meaning thunderstorm. However, alternate etymologies have been traced from various Spanish and French words meaning "to turn." Common names for a tornado include *twister* and *funnel cloud*. The biblical "whirlwind" was probably a tornado.

Wind speeds within a tornado can reach up to 300 mi per hour (480 km per hour). Tornadoes are classified on the Fujita scale, named for Japanese-born American meteorologist T. Theodore Fujita. The Fujita scale runs from F0, a relatively weak tornado that damages only lightly built structures, to F5, a powerful tornado capable of leveling a small town.

Tornadoes develop from supercell thunderstorms, which have a distinctive structure easily recognized by weather radars. Within the supercell storm, winds of different speed and direction create areas of wind shear that produce a rotating column of air known as the mesocyclone. This leads to the development of a wall cloud at the base of the supercell. The tornado proper descends from the wall cloud. Some very powerful tornadoes contain suction vortices, small sub-tornadoes that revolve around the funnel cloud's central axis and leave a distinctive spiral path in the debris field.

Almost all tornadoes in the Northern Hemisphere spin counterclockwise, a behavior believed to be an effect of the Earth's rotation. Occasionally a clockwise tornado is observed, but it is generally weak and almost always a "sister" to one spinning the usual way. A more dangerous tornado rarity is the "invisible" tor-

nado, which lacks a visible funnel. The cloud of dust and debris rising from its base may be mistaken for a harmless dust devil. However, dust devils form primarily on hot, sunny days, so an apparent dust devil under a cloudy sky should be considered a probable tornado.

## U.S. TORNADOES

The UNITED STATES has the highest incidence of tornadoes in the world. The convergence of several geographic features make the American heartland particularly susceptible to these powerful storms. North America's principal mountain ranges run from north to south, with a broad plain between them. The western range, the ROCKY MOUNTAINS, often guides cold Arctic air down onto the midwestern prairie, while the Gulf of Mexico to the south provides a northward flow of warm, moist air. When these air masses collide along weather fronts, they produce the supercell thunderstorms that spawn tornadoes.

A similar geological combination exists in BANGLADESH, with cold air from the HIMALAYAS colliding with warm, moist air from the BAY OF BENGAL across level lowlands. However, while American tornadoes are characterized by relatively low loss of life but enormous monetary losses, Bengali tornadoes often reap enormous numbers of fatalities while causing relatively little property damage. The difference is less meteorological than social and economic: while the American gets ample warning to take cover but must abandon substantial material wealth to the storm, the Bengali has little material wealth to lose but often has no access to any warning system.

America's tornado warning system did not come without significant resistance. For decades, forecasters were strictly forbidden to mention the word "tornado," for fear that they would create a panic. Only after a tornado struck an air force base did that policy change. Two levels of alert were created. A tornado watch means that conditions are favorable for the development of tornado-spawning storms. Watches are laid out over large areas known as "watch boxes" in forecasters' jargon, and are often shown as large red rectangles or parallelograms on weather maps. A tornado warning is issued only when the characteristic "hook echo" of a mesocyclone has been detected by Doppler radar, or a spotter on the ground has sighted a funnel cloud.

There are several notable historical tornadoes. The Tri-State Tornado of March 18, 1925, set numerous records. Crossing from MISSOURI through southern ILLI-

NOIS to INDIANA, it was so wide it did not show a funnel, just a wall of blackness. At 60 mi per hour (97 km per hour), it was the fastest-moving tornado, and its forward movement combined with its rotational speed to increase its destructive power. It remained on the ground for three and a half hours, leaving a path 219 mi (352 km) long and 695 deaths in its wake.

The greatest number of tornadoes spawned by a single weather system occurred during the Superoutbreak of April 3 and 4, 1974. After an extensive study of the damage, Professor Fujita drew a map showing all 148 tornadoes that struck on those two days. The most destructive of them struck Xenia, Ohio, leaving 34 dead and millions of dollars of damage.

Another notable tornado struck Plainfield, Illinois, in 1990. An anomalous tornado, it was not recognized until it was too late to warn the town, and the storm sirens sounded only after the funnel cloud had passed. Fujita came out of retirement to personally study the damage, and his discoveries about these microburst tornadoes led to improvements in tornado forecasting.

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## trade routes

THE SIMPLE DEFINITION of a trade route is an area or proscribed passage by land or sea used by merchants and caravans for economic purposes. A trade route can be established between any multiple points linked by trade, whatever the distance between them, and can exist within a small area or specific region or over vast distances between a number of regions.

While all trade routes exchanged multiple goods, the largest and most famous trade routes became known for the transportation of specific precious commodities such as gold, salt, and silk. Most trade routes also dealt in the trafficking of human beings—some more than others. Trade routes, no matter what commodities they transported, played a vital role in the for-

mation of ancient and medieval empires around the globe and were often sources for the exchange of not only goods, but of people and ideas.

Nearly every political entity that has existed in known world history has been linked to at least one major trade route, and some major polities can be categorized as “trading empires” because their existence came entirely as a result of the trade routes associated with them. It can be said with confidence that the connection between trade routes and the development of cultures and political entities cannot be overemphasized, for trade was a major catalyst for development throughout human history. The need to trade stirred genetic, cultural, and linguistic exchange that would likely have not occurred without this need, so that the routes traders created served as literal conduits of political and social change.

There are two physical types of trade routes: overland and nautical. An overland route connects multiple points by land, and originally was traversed by caravans, or merchants who traveled in groups for convenience and protection. With the invention of the automobile, highways, and pipelines, the need for caravans is largely obsolete, though some caravans still exist along trade routes in less-developed areas of the world. A nautical route is traversed by sea and tends to involve the use of large ships that carry significant quantities of goods, often over vast distances. Nautical routes are the most common and least expensive method of transporting goods in the modern day.

In addition to overland and nautical routes are two forms of transportation of goods that merit mention: riverine and air transport routes. Riverine routes, or passages that follow along or are navigated via rivers, are considered overland routes. Most air routes are nautical, as they tend to cross large bodies of water, though this is not always the case. Air routes are of course a common form of trade transportation today, though for most goods this form of transportation is still prohibitively expensive. If an air route is too expensive or has too limited a space for transporting goods, a nautical route is most often used.

## MAJOR TRADE ROUTES

Examples of trade routes can be found in every part of the world during any point in its history, but there are a few historic trade routes that deserve attention because of their significance:

The Lapis Lazuli Route originated in the Chagai Mountains in modern PAKISTAN and traveled to Hierakonpolis, EGYPT, in the 4th millennium B.C.E., marking

it as one of the oldest known trade routes in human history. As with many major trade routes, it is named after the commodity that was transported—lapis lazuli. A precious mineral prized for its bright blue color, lapis lazuli was used for a number of luxurious and religious items in ancient Egypt in particular.

Alexander the Great linked a number of polities in Europe and Asia to form a basis for trade networks that would continue well into subsequent empires. The ancient Roman trade network that evolved from Alexander’s conquests extended across the entire continent of Europe, through the MIDDLE EAST, then connected to Asian trade routes to extend as far as Chang’an (Xi’an), the capital of the Han Empire, located in central CHINA. Certain cities, like Petra (located in modern JORDAN), became famed as nexus points for trade between the two continents. The incense routes of ancient Arabia were the most famous of this network, though many other precious commodities, including olive oil, spices, gems, and silk, were traded extensively.

The Amber Road, a very ancient route that may have been initiated as early as 800 B.C.E., originated in Jutland (modern DENMARK) on the Baltic Sea, then moved either south and west through Britain to the MEDITERRANEAN or due east along the DANUBE RIVER to the BLACK SEA, then eventually to ITALY via Yugoslavia. The routes for the Amber Road varied according to who was in power in Europe and are a historical measurement of the exchange of political power in the region. The Amber Road also connected to significant tin routes in West and Central Europe, creating an impressive intra-European network.

The SILK ROAD, one of the longest-lasting trade routes in human history, was actually a series of routes that originated in China and extended either north and west through Dunhuang, across the GOBI DESERT into Central Asia and onto Europe, or took a more southern route near the HIMALAYAS through Pakistan, which could connect with ports on the Indian subcontinent to Arabia and the eastern coast of Africa or overland through the Middle East to the Mediterranean. Exotic animals and plants, slaves, gold, and other commodities passed through this route, whose apex occurred during the Tang Dynasty in the 8th century. The Silk Road still exists today, though political instability in Central Asia has largely stopped study of the route except on its eastern end in China.

The trans-Saharan gold trade network latticed the entire northern half of Africa, reaching ports on the Mediterranean for transport to Europe, extended



south into Central Africa, and east to the ports on the coasts that transported gold, copper, salt, and other precious items across the INDIAN OCEAN, reaching as far as China. The trans-Saharan routes were also among the most difficult to traverse, making control of them difficult. The network still exists today, though it lost most of its significance in the 16th and 17th centuries.

The Middle Passage or Atlantic Slave Trade is one of the most infamous trade routes in human history, as its primary commodities were human beings. An enormous nautical corridor of slave trafficking that provided people from West and Central Africa, millions of Africans were forcibly removed from their homelands to work on plantations in the Americas and the Caribbean, while many more were transported to Europe as chattel labor.

The slave trade officially lasted from the early 15th to early 19th centuries, though slaves may have been exported as late as the 1860s to BRAZIL. Most people of African descent in the Americas have origins in West and Central Africa as a result of the Middle Passage slave trade. While slave trafficking was the primary business of the Middle Passage, other items from the Western Hemisphere, including chocolate, corn, tobacco, sugar, and silver were transported back to Europe via this route.

The Spice Routes is the name given to the network of southern passages that linked Asia, Africa, and Europe by sea. They stretched from the west coast of JAPAN, through the islands of INDONESIA, then skirted the southern coast of INDIA to the Middle East and the East African coast, terminating after crossing the Mediterranean into Europe. While sections of these routes were used very early in human history, it was not until European sailors inaugurated the passages in the 16th century that the entire network could be traversed at once. This achievement resulted in European domination of maritime trade routes for the following three centuries. A variety of exotic spices, black pepper, and other valuable trade items were commonplace on Spice Route ships.

The fur trade, inaugurated in the early 17th century, stimulated European exploration and settlement in North America. The trade was conducted mostly along riverine routes, especially on the HUDSON, ST. LAWRENCE, MISSISSIPPI, and Missouri rivers. Europe's insatiable demand for furs, especially beaver for men's hats, led to a thriving trade in pelts with native populations throughout the northern half of the continent. When the demand for furs became too great for native people to provide a sufficient supply, large trading or-

ganizations, including the Hudson Bay and North West Companies, established trapping and distribution centers for fur. Quebec City, Chicago, Detroit, and Minneapolis are all cities that developed as a result of the fur trade. The fur trade waned in the mid-19th century, a result of the depletion of fur-bearing animals in some areas as well as a decreased demand for fur when men's hats were made of silk instead of felt.

## OVERLAND AND NAUTICAL ROUTES

Overland and nautical routes have both existed since the beginning of civilization, though evidence suggests that the first trade routes were overland. Significant overland routes were created in predynastic Egypt, Mesopotamia, and China, and some scholars argue that the need to regulate trade and its conduits prompted the existence of better-organized polities that evolved into the first empires. Most overland routes were patrolled by groups whose sole duty was to protect them, which created an economic niche in and of itself.

Banditry on overland routes was exceedingly common, thus the need for these "policing" groups who obtained "protection" compensation from merchants traveling along passages the policing groups controlled. Trading empires on overland routes specialized in finding ways to make money on their routes, by directing controlling trade, policing the trade areas, or taxing merchants along the passage to gain prosperity. The Silk Road and the trans-Saharan network are examples of overland routes where all of these approaches were applied to generate wealth, and many political entities over time did so with overwhelming success.

In the trans-Saharan example in particular, most of the empires' wealth was generated through taxation, not direct control of the commodities or the traders themselves. Entire towns devoted to providing for the needs of merchant caravans also tended to prosper under this system. Many passages crossed deserts so that oases played a major role in determining the viability of trade routes. Oases became commodities on trade routes as much as transported goods, and many wrested for control of them as a means to generating income.

Nautical routes evolved significantly over time as the demand for trade goods increased. Nautical routes began as short explorations along coasts or across small bodies of water, such as Mediterranean coastal trade in ancient GREECE and Rome and RED SEA routes that connected the eastern coast of Africa with the Ara-

bian Peninsula. Further need to traverse long distances in order to facilitate trade led to the development of larger, faster, and sturdier ships that could navigate the open sea.

The development of the dhow, a fast sailing ship designed for use in the Indian Ocean, connected southern Asia with eastern Africa, the seat of the famous Swahili trading empire. The invention of the caravel, a European trading vessel that was designed to explore the waters in the Atlantic between the Iberian Peninsula and the west coast of Africa, gave Portuguese explorers the means to find nautical trade routes that circumnavigated the continent.

This permanently altered the nature of world trade and arguably gave Europeans enormous economic advantage over the rest of the world from the fifteenth century through the colonial era. Nautical trade was dominated by Europeans in the so-called Age of Exploration, and huge trading monopolies that originated in PORTUGAL, SPAIN, England, and the NETHERLANDS would shape human history as a result of the cultural ideas, technology, goods, and people that were exchanged globally among them. Subsequent eras, in particular the period of colonialism, would not have come about without the existence of the nautical trade routes that led to European domination during this critical and difficult moment in human history.

Most of the world utilized and continues to utilize both overland and nautical passages. While some trade routes became famous for their overland itineraries, they also incorporated nautical legs that transported goods more efficiently once they reached major bodies of water. The incense routes that crossed Arabia often changed from overland to nautical conduits when they reached either the Red Sea or the Mediterranean so that goods could be transported more quickly to northern Africa and southern Europe.

The infamous Middle Passage also consisted of significant overland sections that were used to collect and distribute slaves from the African interior to coastal ports for eventual exportation, as well as having land routes to transport slaves once the ships reached the Americas. Trade routes, like the people who created them, were as adaptable as their creators made them. Trade routes invariably leaned toward efficiency whenever possible, incorporating new technologies, new knowledge, and new participants as all involved used them to achieve their primary goal of exchanging commodities for economic gain.

Trade routes were recognized as extremely valuable assets to any civilization and thus were made, broken,

fought over, redesigned, and exchanged between polities that sought to reap the benefits of their existence. A trade route tended to evolve when a major commodity, or large-scale precious good, became available for distribution.

Perishable goods such as wheat and vegetables were far less likely to be traded large-scale on trade routes, though more exotic staples might exchange hands in small quantities (pasta, potatoes, and chocolate reached disparate parts of the world as a result of being carried along trade routes in this manner.) Of commodities, the examples mentioned earlier in this article are among the most famous, but other commodities that had value throughout history include bronze, ivory, copper, teak, and cowries, and even these are only a minuscule list of available trade route items.

Because of the constant exchange that occurred along trade routes, anything material and immaterial that could be exchanged was. Scholars, soldiers, and explorers seeking new information and adventures were common travelers along trade routes: the famous Italian explorer Marco POLO traveled to China with his merchant family; IBN BATTUTA, a Muslim scholar and adventurer, recorded his travels as he traded throughout Asia and Africa; and Zhang He, China's greatest navigator, charted much of Southeast Asia, the eastern coast of Africa, and the southern Pacific for the purpose of stimulating trade during the Ming Dynasty.

Ideas were exchanged between cultures orally, through books (a common trade item) and other forms of expression as traders and travelers interacted with one another. Some languages, such as Swahili and Mandarin Chinese, developed out of a need for diverse peoples to speak to each other along trade routes. Swahili is termed a "trading language" because it incorporates native African words and Arabic using a simplified grammar meant originally for trade transactions. Mandarin Chinese was adopted as the official dialect of the Mongol rulers of the Yuan Dynasty in order to simplify communication between speakers of hundreds of different dialects and separate languages in their vast empire.

Cartography, or the creation and utilization of maps, evolved significantly as a result of traders' necessity for accurate maps of trade routes. Mapmaking became a major business as people grew more aware of and more curious about the world around them. Traders were the most likely travelers in ages past, so that trade routes often served as the basis for further exploration, which stimulated mapmaking. The great

European explorers of the 15th and 16th centuries were motivated by want of trade to seek new avenues of transport, a famous expedition to the land of “Punt” during the reign of Hatshepsut in ancient Egypt was one of the first recorded explorations in human history, and its description suggests that the expedition’s primary interest was in obtaining new trade items. The maps, illustrations, descriptions, and stories from these expeditions were fortunate but secondary results of the push to trade. They remain as evidence not only of human achievement, but also of the importance of economic aims in increasing the world’s understanding of itself.

Trade routes, while generating many benefits, also were the vehicles for various negative aspects of societal change. Conflicts about trade routes often arose because of their economic consequences. Empires rose and fell because of their dependence on the success of trade routes, and the failure of a trade route or network could lead to socioeconomic devastation: for example, West Africa was permanently and negatively affected when the Saharan trade network waned after Europe discovered nautical routes to Asia, circumventing the African continent. Africa was also devastated by slave trade networks in West Africa and in East Africa, where the Arab slave trade flourished during the 19th century.

The black plague that decimated Europe’s population in the 14th century occurred as a result of the disease being transported via trade ships returning from Asia. Then newly introduced diseases of European origin such as smallpox ravaged the Americas, their native populations having no natural defenses against them. During the Ming Dynasty in China and the contemporary Tokugawa Shogunate in Japan, these countries eventually isolated themselves from the rest of the world as a result of negative experiences with European traders and missionaries. The exchange of ideas, especially religious, often held the potential of being less than beneficial.

Trade routes served as instruments for exchange on many levels, and that their impact is vital to human history. The exchange of resources between cultures led to technological and economic advances that would have otherwise been impossible to achieve, with the added benefit of an exchange of ideas that often turned out positively. Some consequences of cultural exchange produced extremely negative results as well, which only stresses the influence of trade routes on all aspects of society. The magnitude of trade that has existed between cultures across eras reveals its physical manifes-

tation in trade routes, many of which tested the limits of human ability, endurance, and creativity to traverse. Trade routes are hard evidence of human achievement and drive to expand and change.

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## transhumance

TRANSHUMANCE IS THE ancient custom of moving domestic animals from one grazing ground to another, as from lowlands to highlands, with the changing of seasons; sheep, cattle, and goats have all been involved in this annual domestic migration process. The origin of the word partially comes from the French *transhumer*, to move livestock seasonally.

The purpose of transhumance is to move livestock to the cooler highlands to take advantage of freshly sprouted new grass. Animals were also moved from the lowlands up into the mountains to avoid the heat in the plains, particularly in FRANCE and SPAIN. After summering in the cool mountains, the process is reversed in late fall before snowfall makes passage difficult for the return trip. By the time flocks return, autumn rains in the lowland pastures have renewed growth to feed returning flocks. This tradition has been observed for centuries in Europe.

The Romans noted transhumance as an ancient Iberian tradition. Visigoths at the geographical limits of the Roman Empire passed their own laws to allow for free passage of flocks during the annual move. Moors introduced Merino sheep during the 8th century, and their Berber shepherding methods allowed Spain to gain a monopoly on the fine quality wool, which, over the last six centuries, has become one of its most important industries.

Herds are moved early in the spring, both to take advantage of the fresh grass and to avoid the summer

heat, but also because most farms do not have enough pasture for large flocks. For centuries, farmers have burned their fields after harvest to remove dead and depleted vegetation as well as to reduce the acidity of the soil. This custom promoted the regeneration of nutrient-rich grasslands for their animals, as well as fallow time for croplands to recover. Practices such as transhumance lessened the stress to the soil caused by overgrazing.

### MOBILE PASTORAL ECONOMY

Transhumance appears to have originated, if not in Spain, then in the Mediterranean region generally, where the profound climatic variation between coast and mountain led to the development of a mobile pastoral economy. The Spaniard Gregorio de Villalobos is credited with introducing transhumance to MEXICO in about 1521, in the Gulf Coast lowlands when he imported some of the first cattle to New Spain. The colonial economy expanded and transhumance was widely practiced until the cattle ranches became so large they controlled the land that had been used by the native population. Disease eventually decimated the native population, and transhumance was widely abandoned in Mexico.

In several European countries, transhumance still occurs, although in some regions it has developed into a both a celebration and a tourist attraction. René Tramier, president of "The Shepherds," in Provence, France, was concerned that French children thought milk came from cartons. He helped to create an annual festival, Fête de Transhumance, in the town of St. Remy-de-Provence, which attracts both tourists and media.

A tinkling of bells heralds the flock's arrival as the Menon (castrated ram) leads the flock, whose progress is further encouraged by sheep-herding dogs. To prevent the ravenous flock from destroying flowers, shrubs, and vegetable gardens, villagers line the path, brandishing brooms and farm implements to shoo the sheep away from such delicacies.

It was common in France for several herds to make the journey to the new grazing lands together, in groups of two or three flocks. The shepherds' association would appoint a leader to manage each herd. The leader had an assistant and a shepherd with two or three dogs. One member was appointed to go before the herds and make arrangements for them to stop for the night, pay the farmers for the use of the grazing, and purchase any other provisions needed by the sheep or their handlers.

To avoid traveling in herds too large to control, groups in the shepherds' associations would leave several days apart and perhaps take separate routes, that led to a common meeting place. Cheese from ewes' milk was made along the way. The abundant summer grasses, herbs, and wildflowers enhanced its flavor; Zamorano cheese from Spain and Roquefort from France are typical. In ancient times, landowners might only be paid in kind, in the form of milk and cheese, for the use of their land. Occasionally, the shepherds would purchase fodder for the animals if needed.

### TRANSHUMANCE TODAY

In Spain, sheep and cattle ranchers labor to continue the tradition of transhumance, following the routes of their ancestors. But the arduous journey is made more difficult and dangerous by the modern expansion of highways into remote regions. Although the desire to continue the old ways is strong, modern technologies may ultimately cause the end of traditional transhumance in much of the world.

As more and larger highways continue to encroach upon rural areas, herders find it increasingly difficult to drive their herds of sheep, goats, or cattle. Most animals are now transported by truck to avoid the arduous journey, but the cost involved can be quite high. In addition, some shepherds feel that the rapid change in climate is not as healthy for the animals as the trek on foot, which allows them time to acclimate. Yet another reason to move cattle by foot is that the exercise makes for finer, leaner meat.

Transhumance has been followed in rural communities around the globe, including Scotland, Spain, France, SWITZERLAND, NEPAL, INDIA, North Africa, and ITALY. Archaeologists believe there is evidence of transhumance dating back thousands of years in Minoan Crete, during the period 2500 to 1400 B.C.E.

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## transportation geography

THE DISCIPLINE OF GEOGRAPHY aims to describe and explain the nature of spatial variation as observed on the Earth’s surface. There have been a number of ways proposed to divide the discipline, but in the end it is easy to see a HUMAN GEOGRAPHY (the human use of the Earth’s surface), a PHYSICAL GEOGRAPHY (natural processes on the Earth’s surface), and an area where the interest is on the human-environment interface. There are also a whole series of techniques and tools for studying each of these subdivisions. Geographers analyze how human activities are distributed on the surface of the earth, why they are located where they are, and what implications stem from these distributions.

Just about everything in the world of geography has some relationship with transportation. The form and organization of both settlements and the production of goods is intimately and intricately linked to the ability to move people and commodities across space. It was the Greeks who believed that the origin, growth, and development of cities was a direct consequence of human wants and needs. Within this context, we can easily see that it is the existence of cities that creates a demand for transport. At the same time, the development of transport within a given region leads to two interesting outcomes.

On the one hand, transportation serves as a limit to the development of an area. It does this by establishing functional limits to movement of people and commodities within the city sphere. At the same time, the presence of operational limits plays a critical role in shaping the space these very limits bound. This impact is accomplished through a variety of social and economic feedback mechanisms. Looked at slightly differently, we might say that the size and scale of the any given region is directly related to the development of the transportation function within that region.

For most people living before the INDUSTRIAL REVOLUTION, life began and ended in one place. Communi-

ties were largely self-sufficient entities whose geographic boundaries (both physical and political) were generally determined by the distance one could easily walk. This kept most urban forms remarkably compact. It also makes it easy to see how the early development of both economic and political geography was closely tied to the CORE AND PERIPHERY concept. There was no public transport in cities at this time, and inter-city travel was rough and restricted. As James Joyce indicated in *The Story of Passenger Transport in Britain*, travel during the Middle Ages meant that “you could easily trip into a ditch or get stuck in the mud, and you could easily lose your way along unmarked roads that took an indeterminate course across open and desolate countryside.”

If, on the other hand, you were a person of rank, you might just as well fall victim to some roadside thief ready to relieve you of any valuables as you made your way across the unprotected lands between urban centers. Even in some rural settings, the most honest of peasants might throw stones at you, not from any personal motives, but simply because you were a stranger. And in the age of isolation, strangers were never to be trusted.

Transportation is a fundamentally geographical phenomenon. But that does not mean that it does not reflect strong economic undertones. This becomes clear as soon as you remember that the focus of transportation is on the movement of people and commodities through space and thus through time. In simplest terms, transportation is connectivity. When connectivity isn't important, there is little reason for transport, and life goes on at singular locations. But once there is some reason for connection, a host of important factors come into play. Every movement starts somewhere, ends somewhere, and follows a certain route through space and time. Every movement affects, and is affected by, conditions at the origin, the destination, and the various conditions that exist along the way.

Transportation, then, plays a significant role in the development of space as both a factor and a process. As such, the study of transportation must take place across a range of spatial scales, from local to regional to global and across a range of purposes, from social, to commercial, to military.

It has been common to place transportation geography within the broader human geographic context. This is because its conceptual framework is centered human activity within a context of overcoming space subject to various physical geographic limitations. Transportation geography is generally considered to

have two operating themes. The first focuses on transportation and its role in the organization of space. That is, how transportation has affected the shape and character of a place and how it has given place meaning. The best example of this comes from just saying “San Francisco”; most of us first think of the hills and the trolley cars that operate there or perhaps the Golden Gate Bridge

Or one might think of Lombard Street with its numerous turns back and forth across a fairly steep landscape. Say “Venice” (ITALY) and most people think of canals and interesting river taxis. This, then, is the context within which transportation begins to shape a landscape and help give it meaning as place. This category can in turn be subdivided into how transportation is organized geographically and how transportation organizes other human activities. Examples of the former (spatial organization of transportation) include networks, corridors, hierarchies, hinterlands, inter-modal connections, and so on. Examples of the latter (spatial aspects of human society and economy that affect and are affected by transportation) include land use patterns, industrial location, urban hierarchies, information flows, shopping, regional development, trade, and the natural environment.

## LOCATION THEORY

This spatially focused theme of transportation geography played a major role in the development of location theory as a field of inquiry in the early 20th century. Location theorists wanted to develop models that could explain the location of cities and believed that by understanding the where, why, and when of economic location they might come to understand the spatial context of the system of cities and thus predict future locations of human activity. Several distinctly different approaches are used to describe and explain transportation and spatial organization.

One approach is to build conceptual theories and graphic models as a basis for understanding the processes that lead to given spatial outcomes. The second approach is historical and therefore has an interest in both descriptive and process activities as seen through existing patterns and the relationships between them. There is also a third approach that is empirical, that is, data collection, mapping, graphing, statistical analysis, and so on.

The second theme of transportation geography is the one applied to real-world problem-solving needs. This approach, which is heavily but not exclusively quantitative, overlaps with the disciplines of land use

planning, business and industrial location, and engineering. It is common for transportation geographers to use a number of basic transportation models to deal with fundamentally geographic questions. Important questions include topics such as where is traffic generated and where does it go, what mode or means of transport is chosen, what routes are/could be/should be followed, where are networks constructed, and where are activities located.

Most of these questions can be addressed with various kinds of models including descriptive models (where is it?), explanatory models (why there?), predictive models (where will it?), and prescriptive (where should it?). GEOGRAPHIC INFORMATION SYSTEMS (GIS) are widely used as a platform for many geographic transportation models, as is increasing use of global positioning systems (GPS). This branch of transportation geography has become one of the fastest-growing fields recently, although you may see it under a different name. Today, we often use the term *logistics* to refer to this quantitative side of transportation and transportation analysis.

Each of these approaches is, in its own distinct way, an attempt to tell a story about the effect transportation has on spatial patterns and relationships within any geographic space. It is important to remember that technology plays a critical role in transportation geography and the influence transportation has on the organization of human space. The primary result of technological advances that take place in transportation is that they redefine space. It took Marco POLO and his uncle four years to travel to CHINA. Today, we can board an airplane in Rome and land in BEIJING in 6 hours or so.

This influence is also not limited to just physical things. Improvements in transportation technology also influence communication. In the 21st century, the transportation of ideas has become just as significant as the movement of goods. And there are some that might say it is even more important, for it is through the influence of transportation that all territory is described and ultimately limited, whether national or commercial in character.

## TRANSPORTATION GEOGRAPHY BASICS

Movements between one place and another are dependent upon the existence of transportation routes or networks, where the networks contain a number of nodes (place points). Geographically, each node represents either a place, some starting point of destination and intersections, usually considered as intervening op-

portunities in the sense that you have a choice to make about how to proceed. There is also the set of links (lines) that exist between each node and each intersection. There could be any number of these depending on their uniqueness or importance, but they all represent the paths available for travel from one place to another.

Transportation networks have four spatial characteristics. One is network deviousness, or the degree to which the lengths of the individual links differ from the straight line distances between the places being linked together. Another characteristic is network density, or the number of routes in the area. In transportation studies, density refers to both the number and the length of the routes available. This implies that the size of the area is important, as are any physical barriers that may exist such that deviousness is also affected.

Also important are the mode of transportation being considered and the size and scale of economic development. Connectivity refers to the degree to which direct movements are possible over the network. Networks that are most connected are those in which the directness of routes joining up pairs of places is maximized. More connected networks tend to consist of circuit networks in which there is more than one path or route between places.

Less connected networks tend to be dominated by branching networks or trees in which there is only one possible path between places. Connectivity is typically related to the size (and attractiveness) of the area being connected and the degree of economic development. Hierarchy is the recognition that certain nodes and certain links in the network are more important than others. This hierarchy develops as a result of development and the economic specialization of the economic landscape that ensues.

Transportation pricing usually reflects one of three approaches: F.O.B., C.I.F. or basing point. F.O.B. stands for free on board and represents a situation where the purchaser pays the transport cost; that is, the price of the product is its market price plus transportation cost.

C.I.F. stands for cost, insurance, and freight and occurs when the seller assumes the transportation cost generally and one uniform price exists in the market. C.I.F. usually occurs because there is a large volume of sales, it permits competition across all markets, and some firms do not like to compete on a price basis, marketing other factors as important.

Basing point is a practice where the transport charges are established from a particular point in a zone or a region. Such a price scheme is legal as long as

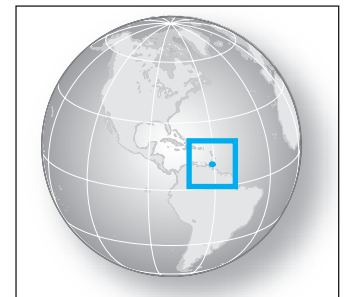
the purchaser has the option of buying F.O.B. and sellers do not collude (previously agree) about the base price. Generally, transportation costs are based on two charges. Terminal charges represent the cost of loading and unloading the carrier, while line-haul costs are associated with transporting the commodity from its origin to its destination.

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## Trinidad and Tobago

**Map Page** 1137 **Area** 1,980 square mi (5,128 square km) **Population** 1,104,209 **Capital** Port-of-Spain **Highest Point** 3,102 ft (940 m) **Lowest Point** 0 m **GDP per capita** 9,500 **Primary Natural Resources** petroleum, natural gas, cocoa, sugarcane, rice.



THE TWO CARIBBEAN SEA islands of Trinidad and Tobago had separate histories until they were joined together as one colony under the British in 1888, then as one nation upon independence in 1962. Today, the islands are among the most wealthy in the region thanks to sizeable resources of petroleum and natural gas.

Trinidad and Tobago lie off the main arc of the Antilles chain, closer and geologically more similar to VENEZUELA (only 7 mi or 11 km) than to its nearest island neighbor, GRENADA. Its mountain ranges and offshore oilfields are extensions of the same features across the narrow channels separating it from the Venezuelan mainland (called the Mouth of the Dragon and the Mouth of the Serpent). The islands also share a

more continental climate—wetter and hotter—than the other islands of the Caribbean and had a fairly large native population akin to the Caribs and Arawaks on the continent. The area was therefore ripe for plantation of the two major features of the islands, religion and cash crops, reflected in the names of the two islands: Trinidad for the Holy Trinity (and also for the three peaks first spotted by Christopher Columbus in 1498), and Tobago for tobacco, grown by the natives. Neither the natives nor the tobacco survived, however, and by the 19th century, sugar plantations dominated the economy, and laborers were imported from Africa and INDIA, forming the basis of the population today. Trinidad was held by SPAIN until captured by the British in 1797. Tobago, unique among the islands of the Caribbean, started out as a colony of the Duke of Courland, a small state in the Baltic (today's LATVIA), before it too passed to British control (via Dutch and French) in 1763.

Today's population reflects this interesting ancestry, with a nearly even split between those with African and Indian ancestry. French and Spanish influences remain, intermixed with cultural elements of African and South Asian peoples—notably in the music and dance forms known as calypso. The black population lives mostly in the cities, while the Asians have spread throughout the rural areas.

Generally peaceful coexistence is sometimes disrupted by political tension, however, as demonstrated by an unsuccessful coup in 1990 by Muslim extremists. The two islands also retain a separate identity from each other. Trinidad is physically much larger and has by far the larger population (only 51,000 people live on Tobago, compared to over 1 million on Trinidad). Trinidad also has the nation's stores of natural resources, and has therefore been more developed for industry and production, while Tobago remains largely undeveloped, focusing instead on tourism.

Trinidad is formed of three mountain ranges, roughly parallel, traveling from west to east across the island. The Northern Range is the highest. Its forested slopes plunge vertically into the sea along the northern coast. Most of the population lives in an urban corridor extending east and west from the capital, Port-of-Spain, along the southern flanks of the Northern Range. The center of the island is flat and is home to most of the sugar industry but also other tropical crops like rice and cacao. Oil and gas reserves are found in the southwestern part of the island and also offshore. Besides developing itself as a producer of crude oil, Trinidad is a center for refining and reexporting oil

products from Venezuela. These businesses have been booming for the last decade and have helped contribute to the stable economy (about a fourth of the gross domestic product) that has established Trinidad's reputation as a great site for foreign investment.

Tobago, 20 mi (32 km) to the northeast, is volcanic in origin, with a central range of hills, and a flat coralline coastal area in the southwest, where the island's principal town, Scarborough, is located. Tobago is cooler and drier than Trinidad, with isolated inlets and beaches, that are becoming the island's chief draw for tourism. Trinidad and Tobago lies south of the Caribbean hurricane belt, meaning greater security for island investors. It is hoped that these newer industries, foreign investment and tourism, will keep the country's prosperity going when the oil runs out in the not too distant future.

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## Tropic of Cancer

THE TROPIC of Cancer is an imaginary line encircling the Earth at the parallel latitude of 23 degrees 30 minutes North of the equator. This is the northern boundary of the Torrid Zone and the most northerly latitude at which the sun can shine directly overhead. It is at this point that the sun's midday rays are vertical at the summer solstice on June 21–22 and is the northern border of the tropics. It is the northern counterpart to the TROPIC OF CAPRICORN. The Tropic of Cancer is one of the five major circles of latitude.

A latitude circle is an imaginary ring around the Earth made up of all the points that have the same particular value for their latitude. They are based on the rotation of the Earth in relationship to the sun. The five major circles of latitude are the ARCTIC CIRCLE (66.5 degrees N), the Tropic of Cancer (23.5 degrees N), the equator (0 degrees N), the Tropic of Capricorn



(23.5 degrees S), and the ANTARCTIC CIRCLE (66.5 degrees S). A circle of latitude is known as a parallel because the circles of latitude are at set distances apart and on some maps they appear parallel. This parallel marks the farthest point north at which the sun can be seen directly overhead at noon; north of the parallel the sun appears less than 90 degrees from the southern horizon at any time of the year. The sun reaches its vertical zenith over the Tropic of Cancer on June 21–22, which is the summer solstice in the Northern Hemisphere. This parallel was so named the Tropic of Cancer because the sun was in the constellation of Cancer at the time of the summer solstice. The tropics or Torrid Zone comprise the area situated between the Tropic of Cancer at the latitude of 23.5 degrees N and the Tropic of Capricorn at the latitude of 23.5 degrees S.

The tropical zone between the Tropics of Cancer and Capricorn receive the rays of the sun more directly than areas in higher latitudes. The average annual temperature of the tropics is higher and the seasonal changes are not as diverse as in other zones. The seasons in the tropics are not indicated by temperature but by trade winds off the oceans, which generate seasonal rains called monsoons over the eastern coasts. Several different climatic types are notable within the tropical zones, which are determined by distance from the ocean, prevailing wind conditions, and elevation. The tropics are home to the world's vast regions of tropical RAINFORESTS. The AMAZON and CONGO are examples of the tropical rainforest regions in the tropical zone.

The rainforest vegetation growth is credited to the monsoon rains and contains a wide variety of the Earth's most unique plant and animal life. The northern and southern limits of the tropics are low latitude savanna, steppe, and desert regions and have decreasing seasonal rains. Tropical highland and mountain climates, which are characterized by more temperate climates, also exist where high mountain ranges lie in the zone. The high temperatures and abundant rainfall are ideal for cultivating crops of rubber, tea, coffee, cocoa, spices, bananas, pineapples, oils, nuts, and lumber; which are the leading agricultural exports of the countries in the tropical zone.

The tropical rainforests are in danger from research progress in tropical medicine, advancing technology, and the demands of growing populations that have led to the cultivation and settlement of some rainforest areas. This has resulted in deforestation of the tropical forests, a condition thought to contribute to the greenhouse effect, global warming, and the elimination of many unique plant and animal species.

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## Tropic of Capricorn

THE TROPIC of Capricorn is an imaginary line encircling the Earth at the latitude of 23 degrees 30 minutes south of the equator. It is the farthest southern latitude at which the sun can appear directly overhead. It is the southern counterpart to the TROPIC OF CANCER. Below this line is the southern temperate zone and north of the line are the tropics. The Tropic of Capricorn is so named because 2,000 years ago, when it was discovered that the sun appeared directly overhead at this latitude during the winter solstice, it was entering the zodiac constellation sign of Capricorn. The sun now appears in the constellation of Sagittarius at its southernmost point.

The term *Capricorn* comes from the Latin words *caper* "goat" and *cornu* "horn" and is one of the 12 constellations in the zodiac. The Tropic of Capricorn is one of the five major circles of latitude that are on maps of the Earth. The circles of latitude are imaginary rings around the Earth and comprise the points that have the same value of latitude in relation to the sun. The five major circles of latitude are the ARCTIC CIRCLE (66.5 degrees N), the Tropic of Cancer (23.5 degrees N), the Equator (0 degrees N), the Tropic of Capricorn (23.5 degrees S) and the ANTARCTIC CIRCLE (66.5 degrees S). A circle of latitude is known as a parallel, because the circles of latitude are at fixed distances apart and on some maps they appear parallel.

The Tropic of Capricorn is the southern boundary of the tropics. This parallel marks the farthest point south at which the sun can be seen directly overhead at noon, south of the parallel the sun appears less than 90 degrees from the northern horizon at any time during the year. The sun reaches its vertical position over the Tropic of Capricorn on about December 21–22 which is the summer solstice for the Southern Hemisphere.

The tropics or Torrid Zone comprises the area situated between the Tropic of Cancer at the latitude 23.5 degrees N and the Tropic of Capricorn at 23.5 degrees

S. Every point within the tropics receives the perpendicular rays of the sun at noon on at least one day of the year. The sun is directly overhead at the latitude of 23.5 degrees N on June 21–22, the summer solstice, and at a latitude of 23.5 degrees S on December 21–22, the winter solstice.

The tropical zone between the Tropics of Cancer and Capricorn receives the rays of the sun more directly than areas in higher latitudes. The average annual temperature of the tropics is higher and the seasonal changes of temperature are not as diverse as in other zones. The seasons in the tropics are not indicated by temperature but by trade winds off the oceans which generate seasonal rains called monsoons over the eastern coasts. Several factors determine climatic changes within the tropical zone; distance from the ocean, prevailing wind conditions, and elevation. The tropics are home to the world's vast regions of tropical RAINFORESTS. The AMAZON and Congo are examples of the tropical rainforest regions in the tropical zone.

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## tsunamis

*TSUNAMI*, a Japanese word whose characters translate as “harbor wave,” has become the internationally used term that refers to a series of waves traveling across the ocean with extremely long wavelengths (the distance between wave crests), considerable length, and high velocity. The image most people have of a tsunami is a large, steep wave breaking on the shore. This image is hardly, if ever, the case. Most tsunamis appear as an advancing tide without having a developed wave face, resulting in rapid flooding of low-lying coastal areas and causing them to often be referred to as tidal waves, but they have no connection with the weather or with tides.

A tsunami generally consists of a series of waves, often referred to as the tsunami wave train. Much of the damage inflicted by tsunamis is caused by strong currents and floating debris. The small number of

tsunamis that do break often form vertical walls of turbulent water called bores. Tsunamis will often travel much farther inland than normal waves, given the tremendous volumes of water involved. Tsunamis are comparatively rare events, occurring every 25 to 50 years in Hawaii, for example.

Most tsunamis are generated by shallow earthquakes in subduction zones, where the Earth's drifting plates that make up its outer shell, or lithosphere, converge, and the heavier oceanic plate dips below the lighter continents. The only subduction zones around the Atlantic are the Puerto Rico Trench and the Antilles subduction zone around the eastern Caribbean and the South Sandwich Trench south of South America. These subduction zones are both smaller and much less active than the subduction zones that circle the Pacific, so the Atlantic has many fewer tsunamis.

Most tsunami events are restricted to the Pacific basin, an area surrounded by volcanic island arcs, mountain chains and subduction zones that have earned the region the nickname the RING OF FIRE.

Tsunami waves can also be created by volcanic activity or by landslides that might occur both above and below the sea surface. In fact, the most deadly tsunami in recorded history followed the eruption and virtual obliteration of Indonesia's Krakatoa Volcano in 1883. But generally, these types of tsunamis have much less energy than those produced by submarine faulting, and their size and energy dissipates rapidly with increasing distance from the source.

On the open ocean, tsunami waves can approach speeds of 500 mi per hour (800 km per hour), about as fast as a passenger jet. In deep water, the waves spread out, with hundreds of miles between crests making them scarcely noticeable from the deck of a ship. But in fact, the tsunami crest is just the very tip of a vast mass of water that has been put in motion. Though wind-driven waves and swells are confined to a shallow layer near the ocean surface, a tsunami extends thousands of feet deep into the ocean. Because the momentum of the waves is so great, a tsunami can travel great distances with little loss of energy.

As the waves in the tsunami reach shore, they slow down due to the shallowing of the sea floor, and the loss in speed is often accompanied by a dramatic increase in wave height. Depending on the geometry of the seafloor warping that first generated the waves, tsunami attacks can take different forms. In certain cases, the sea can seem at first to draw a breath (run-up) and empty harbors, leaving fish flopping on the mud. This sometimes draws the curious to the shore-

line and to their deaths, since the withdrawing of the sea is inevitably followed by the arrival of the first tsunami wave. Regardless, the incoming wave approaches much like the incoming tide though on a much faster scale. Given the huge mass of water behind a tsunami run-up, the waves then inundate the coast, snapping trees like twigs, toppling stone walls, and smashing houses, buildings, and anything else in its path.

Because major tsunami events are rare, we tend to forget the devastating power and destructive force they are capable of. In addition to the recent, December 26, 2004, devastating tsunami in the Indian Ocean, there have been a number of other major events over the past 75 years. These include the 1929 Grand Banks Tsunami near Newfoundland that was triggered by an undersea landslide and the 1952 Kamchatka Peninsula Tsunami that overran Midway Island with one meter (3.28 ft) of water before hitting Hawaii. The Island of Kauai, Hawaii, was hit twice as hard by this tsunami as it was by the Aleutian Islands tsunami in 1946, and the run-up at Haena reached 16 m (50 ft).

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## Tunisia

**Map Page** 1113 **Area** 63,170 square mi (163,610 square km) **Population** 9,924,742 **Capital** Tunis **Highest Point** 5,065 ft (1,544 m) **Lowest Point** -56 ft (-17 m) **GDP per capita** \$6,600 **Primary Natural Resources** oil, olives, olive oil, grain, tomatoes.



LONG BEFORE THE ROMANS sacked the Phoenician city of Carthage, Tunisia, located in the center of the North Africa's MEDITERRANEAN coast, influenced the region's land and sea routes. Since then, the Roman, Arabs, Ottoman Turks, and French rulers have all benefited from the perfect location until independence in 1956, when three decades of the Bourghiba regime would follow; a regime of extensive secular advances including the prohibition of polygamy, mandatory and free education, the emancipation of women, and a general direction against fundamental Islam.

President Habib Bourghiba was dismissed because of senility in 1987, and past ambassador and prime minister Zine El Abidine Ben Ali came into political power with a relative continuity of Bourghiba national policies.

### MAGNIFICENT COASTS

Tunisia is a relatively small republic, only slightly larger in size than the state of GEORGIA, with long white sand beaches, date, olive and citrus groves, numerous Phoenician, Roman, and Islamic ruins and sites, and the booming capital city of Tunis. Magnificent coasts primarily face both north and east, and the country looks toward the Mediterranean Sea.

With a sparsely populated western inland spine of mountain ranges, the interior is arid, rocky, and sandy, scattered with lush crossroad oases, dune fields, PLAYA lakes and wadis, and steep peaks. The popular azure coasts are dotted with major cities thriving from expanding port and harbor use, agriculture, industry, and now healthy and repeat tourism—a new thrust and growing revenue generator in Tunisia.

With more than 4 million tourists visiting each year, tourism now employs more than 400,000 Tunisians, increasing its role as a key player in the Mediterranean and North Africa for its location, beauty, bounty, and charm. Since its earliest Roman days, the land of the "lotus-eaters," known for its turquoise coves filled with bountiful fish and inland oases abundant with fruits and cool water, has been in a strategic position on the Mediterranean.

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## Turkey

**Map Page** 1121 **Area** 301,384 square mi (780,580 square km) **Population** 68,893,918 **Capital** Ankara **Highest Point** 16,945 ft (5,166 m) **Lowest Point** 0 m **GDP per capita** \$6,700 **Primary Natural Resources** antimony, barite, coal, copper, emery.



TURKEY IS A NEAR Middle Eastern country located in northwestern Asia with a toehold in extreme south-eastern Europe. It is about the size of TEXAS and LOUISIANA combined. About 3 percent of Turkey's land area is in Europe. Thrace, its European area, is about the size of VERMONT at 9,412 square mi (24,378 square km). Its Asian area (Asia Minor) is called Anatolia and covers 291,971 square mi (756,202 square km). Turkey's coastline is 2,211 mi (3,558 km) long.

Turkey's eastern border is shared with IRAN, AZERBAIJAN, ARMENIA, and GEORGIA. Its Anatolian northern border is on the BLACK SEA. Its Thracian territory borders BULGARIA and GREECE on the north. Its western coast lies on the AEGEAN SEA facing Greek islands. The western part of the southern border is its MEDITERRANEAN SEA coast until it meets the Asian mainland. The center of its southern border is shared with SYRIA. The eastern part of its southern borders is shared with IRAQ.

Turkey has seven major regions: the Black Sea region, the Marmara region, the Aegean, the Mediterranean, Central Anatolia, East Anatolia, and Southeast Anatolia. The Black Sea region extends from the Bosphorus Strait to Georgia. The Northern Plains run along the western half of the Black Sea coast in a narrow belt until the Northern Mountains meet the Pontic Mountains.

### PONTIC MOUNTAINS

The Northern Mountains cover a large area in of northwestern Asiatic Turkey. They meet the Pontic Mountains about midway along the Black Sea coast. The Northern Plains then continue along the Pontic Coast of the Black Sea to the border with Georgia. In some areas the mountains come all the way to the coast. The Northern and Pontic Mountains receive enough moisture for them to be heavily wooded. There are only a few roads through the Pontic Mountains to the Black Sea.

The Thracian part of the Marmara region is covered by the Northern Plains, an area of gentle rolling grass lands and farms. Historic ISTANBUL (Constantinople) is located in European Turkey on a peninsula at the intersection of the Bosphorus and the Sea of Marmara. An estuary called the Golden Horn separates it from newer areas. In addition, Istanbul has expanded across the Bosphorus to the Asian side. European Turkey is separated from Asiatic Turkey by three connected waterways: the Bosphorus Strait, the Sea of Marmara, and the Dardanelles.

The Bosphorus Strait, one of the world's busiest waterways, is a narrow outlet from the Black Sea to the Sea of Marmara. It is only a few hundred yards wide at its narrowest point. The Sea of Marmara is a saltwater sea but almost completely surrounded by land. It opens onto the Dardanelles, which is a strait formed by the Gallipoli Peninsula and the Northern Plains. The Island of Marmara in the Sea of Marmara is an important source of high-quality marble. The Northern Plains also extend along the Asiatic side of the Sea of Marmara, and beside the Dardanelles, they open onto the Aegean Sea.

The Aegean coast has many bays, peninsulas, coves, islands and fine sandy beaches. Its narrow coastal plains rise through the broad fertile Western Valleys to the Anatolian plateau. The Western Valleys produce numerous agricultural products, including olives, tobacco, and cereal grains. They contain the Gediz Plain and the Great Menderes Plain where grapes, figs, and citrus are grown.

The sea changes from the Aegean off the Island of Rhodes to the Mediterranean. The southern Mediterranean coast has a narrow belt of plains, the Southern Plains, that run from the Gulf of Antalya to the border with Syria. Rising just inland are the Southern Mountains, the most important of which are the Taurus Mountains (Toros Daglari). They are a folded chain of mountains.

The Taurus range runs eastward until it reaches the Arabian Platform, where it arcs around the northern side of the platform. The Taurus Mountains are rugged and have historically been a barrier to travel between the Mediterranean coast and the Anatolian Plateau except for a few mountain passes such as the Cilician Gates (Gülek Bogazi), northwest of Adana (Tarus).

The Central ANATOLIAN PLATEAU is a region of a small rivers fed by only occasional rainfall. Without irrigation the land is usually just grazed by herding. There are several salt lakes in central Turkey. It contains the volcanic tuff region of Cappadocia in the



south, an area larger than RHODE ISLAND that has strangely shaped rock formations.

The Eastern Anatolian Plateau region is an area of rugged towering mountains. The area lies east of the Euphrates River and extends to Mount Ararat and the borders with Armenia and Iran. It also contains the large freshwater body, Lake Van, which is part of the original homeland of the Armenians. The Southeastern Anatolian region is part of Mesopotamia. It is a region of fertile plains and river valleys that lie between Turkey's share of the Euphrates and Tigris rivers. The Euphrates rises near Erzurum in the Eastern Plateau. The Tigris rises in the Taurus Mountains near Lake Hazer in the Eastern Plateau.

Numerous Kurds live beyond the Tigris River in the Eastern Plateau in extreme southeast Turkey along its borders with Iraq and Iran. The Anatolian Plateau was an important part of Hittite, Armenian, Persian, Roman, Hellenistic, and Byzantine empires. Since its conquest by the Ottoman Turks in the Middle Ages, it has been the home to the Ottoman Empire and to modern Turkey.

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## Turkmenistan

**Map Page** 1119 **Area** 188,456 square mi (488,100 square km) **Population** 4,863,169 **Capital** Ashgabat **Highest Point** 10,298 ft (3,139 m) **Lowest Point** -265 ft (-81 m) **GDP per capita** \$5,700 **Primary Natural Resources** petroleum, natural gas, coal.



TURKMENISTAN, KNOWN for its deserts, oil potential, and strong authoritarian government, achieved its independence in 1991 following the collapse of the So-

viet Union. The sparsely populated republic borders the CASPIAN SEA to the west, KAZAKHSTAN to the northwest, UZBEKISTAN to the north and east, AFGHANISTAN to the southeast, and IRAN to the south.

The topography of Turkmenistan is dominated by the Turan Depression and the Garagum Desert, which comprises 80 percent of the country's area. Limited mountainous areas exist within the KOPET MOUNTAIN range along the southwestern Iranian border. Turkmenistan's climate is predominantly continental subtropical desert, with very little rainfall. The availability of water is a pressing issue, with the vast majority of the country lacking a constant water source. Turkmenistan borders the Caspian Sea and contains much of the AMU DARYA, the longest river in Central Asia.

Turkmenistan is also home to the Garagum Canal, which stretches from the Amu Darya in the east near the Afghan border for 700 mi (1,100 km) into the southern desert. Soviet planners began the canal during the 1950s, and current efforts are under way to push the canal to the Caspian Sea. While the canal has brought significant acreage into cultivation, it has also diverted water from the Amu Darya and contributed to the shrinkage of the ARAL SEA. Although not bordering the Aral Sea, Turkmenistan continues to suffer the associated consequences of unsanitary drinking water and high infant mortality. Turkmenistan's Kopet dag region is seismically active, as the capital city of Ashgabat was destroyed in a 1948 earthquake.

Turkmenistan's relatively sparse population is centered on the capital city of Ashgabat, with minor concentrations in the western Caspian Sea basin around Turkmenbashi and Nebit Dag and an eastern concentration around Mary and Charjew. Ethnically, Turkmenistan is made up of Turkmen (85 percent), Uzbek (5 percent), and Russian (4 percent) peoples. The major religions in Turkmenistan are ISLAM (practiced by 89 percent of the population) and Eastern Orthodox (9 percent). Major languages spoken in Turkmenistan include Turkmen (spoken by 72 percent of the people), Russian (spoken by 12 percent), and Uzbek (spoken by 9 percent).

Turkmenistan's economy is dominated by the primary sector, including natural gas and oil extraction and agricultural production of cotton. Economic data are classified as "state secret," although international estimates place the proportion of Turkmenistan's population living below the poverty line at 50 percent. Turkmenistan has been slow to adopt market reforms, and state-run control of the economy is still strong. The authoritarian regime of President Saparmurat

Niyazov (self-proclaimed Turkmenbashi, or “leader of the Turkmen”) has outlawed all opposition political parties. The tradition of carpet making continues in Turkmenistan, considered the source of the highest-quality wool and silk carpets in the world.

Turkmenistan is plagued by a poor relative location. While well endowed with oil and natural gas resources, a relatively poor human resource base and lack of export infrastructure hinder Turkmenistan’s economic development. Turkistan’s delivery of Caspian Basin natural gas and petroleum to world markets remains a problem. Any potential export routes must pass through Iran, AZERBAIJAN, or RUSSIA. Additional issues confronting Turkmenistan include slow privatization of the economy, widespread poverty, and relatively high levels of external debt.

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## Turks and Caicos islands

AN OVERSEAS DEPENDENT territory of the UNITED KINGDOM, the Turks and Caicos islands lie at the southeastern end of the BAHAMAS chain, north of HAITI in the CARIBBEAN SEA. Physically, culturally, and economically similar to the Bahamas, the islands have nevertheless maintained a separate identity across three centuries of British rule and continue to hold fast to their British roots in the postcolonial Caribbean.

With an area of 168 square mi ((430 square km), the islands’ capital is Cockburn Town. The territory is composed of two groups, the Caicos islands and the much smaller Turks islands. Only eight of the approximately 40 islands are inhabited: Providenciales in the Caicos (known as Provo) has the largest population, though the capital, Cockburn Town, is on Grand Turk. Provo is also the center for the islands’ tourism industry. Other islands are privately owned (some developed as resorts, like Pine and Parrot cays) or were once occupied but are now abandoned (like East Caicos). Only about 15 percent of the population consider themselves “belongers,” the remainder being temporary residents

from Haiti, the DOMINICAN REPUBLIC or the UNITED STATES.

The islands are low-lying and very dry. Most of the vegetation consists of scrub and cactus. Salt pans have therefore played a large role in the islands’ economy since the earliest days, providing passing ships with salt necessary for keeping meat for the long voyage across the ATLANTIC. Each of the two island groups has extensive encircling coral reefs, the Caicos reef being one of the largest in the world. The islands are separated by the Turks Island Passage, a trench with depths up to 7,000 ft (2,100 m) that connects the Atlantic and the Caribbean Sea. The passage is rich in marine life, attracting numerous diving tourists, who are also drawn to the nearby Caicos Banks, where the sea floor rises suddenly to only 30 ft (9 m) in less than 3,000 ft (1,000 m)—a death trap to sailing ships, whose hulls continue to litter the area.

There is speculation that the island first spotted and named San Salvador by Christopher Columbus was Grand Turk, not Watling in the Bahamas. The island was subsequently named for the Turk’s head fez cactus, while its neighbors took their name from the native words *caya hico* (string of islands). The native Taino population did not survive long after first European encounters, and the islands were sparsely settled by the British from the 17th century. Settlers grew cotton and produced salt and tried to keep their islands from becoming a pirate haven like those of the Bahamas to the north.

Governed as part of the JAMAICA colony from the late 19th century, the islands opted out of the independence that was granted to Jamaica in 1962. Salt production has ceased, so the islands are dependent on British financial support and on tourism, mostly from the United States. The British government has had to step in a few times to combat drug trade and local corruption, but growing tourism and offshore banking are now providing Turks and Caicos islanders with one of the strongest economies in the region. It is also the center of a new marine wildlife initiative to monitor numbers and health of dolphins and whales and tropical and subtropical waters.

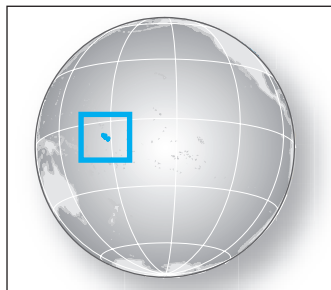
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## Tuvalu

**Map Page** 1128 **Area** 4 square mi (10 square km) **Population** 11,305 **Capital** Funafuti **Highest Point** 15 ft (4.6 m) **Lowest Point** 0 m **GDP per capita** \$1,100 (2000) **Primary Natural Resources** copra, fisheries, tourism, coconuts.



TUVALU IS ONE OF the world's smallest sovereign nations and remote countries. Tuvalu is a group of nine atolls scattered between the 501,932 square mi (1,300,000 square km) of the western PACIFIC OCEAN between KIRIBATI and the Samoan Islands. The nine islands consist of five low-lying coral atolls and four pinacles that jut out of the ocean.

The significance of the geology of Tuvalu has been recognized for many years, with expeditions being sent from Great Britain to the islands as early as 1900. The existence of coral rock formations submerged to depths of more than 984 ft (300 m) has been explained by the coral forming over a slowly submerging volcano.

Tuvalu's climate is tropical, moderated by trade winds. The temperature averages around 86 degrees F (30 degrees C) with little seasonal variation, though the wet season is long (October to March) and humid. In response to the global climate change, Tuvalu's underground water table is threatened as the highest point in Tuvalu is just 15 ft (4.6 m) above sea level. Excessive clearance of forest undergrowth has also caused environmental concerns, and there is damage to coral reefs from the spread of the crowns of thorns starfish. There are no native mammals on Tuvalu; the only mammals are the introduced species of dog, pig, chicken, and Polynesian rat. Humans have lived on the islands for as

long as 8,000 years. The islands had an estimated pre-1900 population of no more than 3,000. Presently, there are 11,146 Tuvaluans, of whom 96 percent are Polynesian and 4 percent Micronesian. The majority of the population are Christian.

The islands were named the Ellice Islands in 1819. In order to protect its inhabitants from Peruvian slavers, the British annexed the islands and formed a protectorate with the Gilbert Islands in 1892. During World War II, the Japanese invasion into the Pacific reached as far as the Gilbert Islands, just to the north of Tuvalu, and the UNITED STATES established a defensive post and built airfields and bunkers on the islands.

In 1974, ethnic differences between the Micronesian Gilbertese and Polynesian Ellice led the islanders to vote for separation. In preparation for independence, the British government granted Tuvalu self-governance and, in 1978, the nation was granted independence and adopted its precolonial name of Tuvalu, meaning "eight standing together" (although the group actually contains nine islands). Tuvalu became the 38th member of the British Commonwealth and, in 2000, the 189th member of the United Nations organization.

Tuvalu's main industries are fisheries, copra, and tourism. Development aid is provided through the Tuvalu Trust Fund, which was established by AUSTRALIA, Britain, South KOREA, and NEW ZEALAND in 1987. The economy also benefits from a 1988 fisheries treaty signed with the United States, which contributes around \$9 million to the gross domestic product (GDP) each year.

Telecommunications are a significant earner for the local economy, after the leasing of its area code for "900" numbers and the contract leasing of its internet domain name, ".tv," for \$50 million in royalties annually over a 12-year period. Remittance from overseas workers is another major contributor to the country's economy.

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## Uganda

**Map Page** 1114 **Area** 146,608 square mi (236,040 square km) **Population** 25,632,794 **Capital** Kampala **Highest Point** 16,765 ft (5,110 m) **Lowest Point** 2,037 ft (621 m) **GDP per capita** \$1,200 **Primary Natural Resources** copper, cobalt, hydropower.



UGANDA IS A LANDLOCKED east-central African country bounded by TANZANIA and RWANDA on the south, CONGO (formerly Zaire) on the west, SUDAN to the north, and KENYA to the east. It is situated on a fertile plateau in the center of which is Lake Kyoga. The plateau extends to the Great Rift Valley, with Lakes Albert and Edward on the west, the RUWENZORI and Virunga mountains on the southwest, and Lake Victoria on the south.

Bantu-speaking peoples apparently first migrated into the area more than 2,500 years ago. By the 1300s, three kingdoms had emerged: Bunyoro, Ankole, and Buganda. During the 1700s, Buganda began to expand and raid the others for cattle, ivory, and slaves. By the 1840s, Buganda had made contact with Arab traders who provided firearms, cloth, and beads for ivory and

slaves. In 1862, John Hanning Speke, a British explorer searching for the source of the NILE, became the first recorded European to visit Buganda. He met with King Mutesa I, as did Henry M. Stanley in 1875. Stanley convinced Mutesa to allow missionaries to enter his realm. In 1884, Mutesa was succeeded by King Mwanga, who began to persecute Christians and was deposed. He regained the throne in 1889, only to lose it again within weeks. In early 1890, he regained it again and signed a treaty of friendship with GERMANY. That alarmed Britain, which secured a treaty with Germany that gave the UNITED KINGDOM rights to the area.

Frederick Lugard of the Imperial British East Africa Company arrived with British troops and in 1894 the United Kingdom officially made Uganda a protectorate. The British introduced cultivation of cotton, which became the major export crop. Coffee and sugar production began in the 1920s; however, the area attracted few permanent European settlers. Instead, Asians primarily from INDIA, PAKISTAN, and the former Portuguese colony of Goa began playing a leading role in commerce.

On October 9, 1962, Uganda became independent, with Milton Obote as head of state. He was deposed in January 1971 by Idi Amin, who ordered 60,000 Asians to leave. Since they had played a significant role in Ugandan business and finance, their expulsion crippled Uganda's economy. Amin's rule was eccentric and bru-

tal with an estimated 300,000 Ugandans killed during the 1970s. He aligned the nation with radical causes, leading to such public embarrassments as Israel's successful raid on the Entebbe airport in 1976 to rescue airplane passengers hijacked by Palestinians.

In 1976, Amin declared himself president for life and attempted to annex western Kenya and the Kagera region of Tanzania. That led to a series of military defeats and Amin fleeing into exile in SAUDI ARABIA, where he died in 2001. Obote returned to power, but civil war followed with approximately 200,000 Ugandans seeking refuge in neighboring Rwanda, Congo, and Sudan and a reported 100,000 Ugandans reported killed. In 1985, a military coup deposed Obote but the National Resistance Army, an anti-Obote group led by Yoweri Museveni, kept fighting after it was excluded from the new government. It seized control on January 29, 1986, and Museveni was declared president. A ban on political parties was lifted in 1996 and Museveni won 72 percent of the vote thanks to the country's economic recovery.

Agriculture is the most important sector of the economy, employing over 80 percent of the work force. Coffee accounts for the bulk of export revenues. Ethnic Bantus account for 67 percent of the population, East Nilotics, 12 percent; Western Nilotics, 15 percent; and the Central Sudanic, less than 5 percent. Christians account for 70 percent of the population and 28 percent are Protestant.

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## Ukraine

**Map Page** 1132 **Area** (233,089 square mi (603,700 square km) **Population** 47,732,079 **Capital** Kyiv (Kiev) **Highest Point** 6,762 ft (2,061 m) **Lowest Point** 0 m **GDP per capita** \$4,500 **Primary Natural Resources** iron ore, coal, manganese, oil.



WHERE EUROPE EDGES into Eurasia, there lies Ukraine, from ancient times known for its fertile black soil, or *chornozem*, imparting to this great rolling steppe land the distinction of having been “the breadbasket of Europe.” As such Ukraine, meaning “the borderland,” has been the coveted prize of neighboring empires and regimes, particularly those of RUSSIA, GERMANY, AUSTRIA, HUNGARY, POLAND, and TURKEY.

Frequently dismembered by or among them, a consciousness of national identity nevertheless endured, and in 1991, when the Soviet Union dissolved, Ukraine reemerged on the maps of Europe, internationally recognized as an independent state. It is the second-largest country in Europe.

### PLAINS AND PLATEAUS

Topographically, Ukraine consists mainly of plains and plateaus, with less than 5 percent of the national territory being over 1,640 ft (500 m), in the Carpathian and Crimean mountains. The climate is temperate, semicontinental, and cool, with precipitation decreasing from west to east while temperatures increase from north to south. Soils and associated vegetation zones have developed accordingly, from the marshy, glaciated lowlands of Polissia in the north to the forest steppe zone to its south, characterized by fertile soils supporting deciduous forests.

Further south can be found the *chornozem* soils and finally a broad grassland zone that extends to the BLACK SEA. It is characterized by chestnut soils and considerable salt accumulation and is subject to drought. Most of Ukraine's major rivers (the Dnipro, Dniester, Boh, Pripet, Desna, and Donets) are part of the Pontic watershed and drain into the BLACK and Azov seas, although the rivers of the northwest, the San and Buh, empty via the Vistula river into the Baltic Sea. Kyivan Rus' arose in the mid-9th century as a result of the international trade and communication routes provided by these river systems, connecting the Scandinavian peoples of the Varangian (Baltic) Sea with Byzantium, Central Asia and the Islamic world.

Although significant numbers of Ukrainians have dispersed throughout Western Europe as labor migrants since 1991, adding to an existing Ukrainian diaspora located primarily in CANADA, the UNITED STATES, AUSTRALIA, and the UNITED KINGDOM, Ukraine remains home to some 48 million people, overwhelming Ukrainian by ethnicity. An ENCLAVE of Russians and Russian-speaking Ukrainians is found on the eastern side of the country's principal river, the Dnipro, in the region known as “Left Bank Ukraine.”

Smaller minority communities include the Crimean Tatars, Belarusians, Poles, Bulgarians, Romanians, Moldovans, Hungarians, Jews, and Roma. The capital city is Kyiv, once the center of Kyivan-Rus'. Via Byzantium Christianity was introduced from Kyiv throughout the eastern Slavic realm of Europe, beginning in 988, in the reign of Volodymyr the Great.

Most Ukrainians still identify with various Orthodox denominations, although in "Right Bank" Ukraine, particularly in Galicia, a region once under Austro-Hungarian and later Polish control, centered on Lviv, Ukrainian Catholicism predominates. As a consequence of the Treaty of Brest of 1596, Ukrainians here maintain traditional Orthodox practices, including a married priesthood, but have an allegiance to the Roman Catholic Church and the pope, the bishop of Rome.

### DISTINCT HISTORY

Ukrainians, although related to the Russians and Belarusians, are a people with a distinct language, culture and historical experience, which separate them from their near neighbors. Imperial (tzarist) Russian historiographers and, at times, their Soviet successors, repeatedly attempted to subsume them, referring to Ukrainians as "Little Russians." These scholars tried to appropriate entirely the patrimony of Kyivan Rus', banning the Ukrainian language and literature, even asserting there never was and never would be a Ukrainian nation. This assimilationist Russification project failed, despite several centuries of effort.

Easily accessed from west or east, much of Ukraine was ravaged over the centuries by various invasions, notably those of the Mongol-Tatars, who sacked Kyiv in 1241. Subsequently, despite Polish, Lithuanian, Tatar, and even Swedish interventions, it was Muscovy that became the dominant regional power, as the Russian empire expanded south. Resistance to foreign occupation was offered primarily by Ukrainian cossacks, notably during the campaigns of the great leader, or hetman, Bohdan Khmelnytsky (1595–1657).

By 1795, however, Ukraine was fully occupied and partitioned, most held by the tzarist Russian Empire with a portion in the southwest under Austro-Hungarian control. Several attempts were made to reassert Ukrainian independence in World War I, particularly between 1917 and 1921. Eventually, western Ukrainian territories were incorporated into interwar POLAND, Czechoslovakia, and ROMANIA, while the remainder of the country fell under Soviet rule, with various territorial realignments subsequently precipitated by the

Nazi-Soviet pact (1939–41) and their later falling-out. Ironically, Ukrainian lands were finally reunited under Soviet hegemony after the war, with the peninsula of Crimea appended in 1954 by Nikita Khrushchev, a symbolic "gift" from the Russian people to the Ukrainians celebrating 300 years of allegedly "fraternal" association. Before, during, and after the war, despite severe repression, national liberation movements contested foreign domination. In the postwar period, political and religious dissidents likewise challenged the Soviet state.

### EFFECTS OF WORLD WARS

Ukraine's rich natural resources were exploited and its population massacred or enslaved during both world wars. In World War II, Ukraine lost more of its people than any other nation in Nazi-occupied Europe. Those losses further weakened demographically a nation that had already suffered many millions of deaths during the genocidal Great Famine (or Holodomor) of 1932–33, a Stalinist crime against humanity. Environmental degradation further soiled Ukraine during the Soviet period, particularly after the catastrophic nuclear disaster at Chernobyl in April 1986. Political corruption, a weak civil society, declining birth rates, out-migration and a failure to undo the consequences of communism, coupled with resurgent Russian pretensions over the fate of Ukraine, currently threaten the country's stability and even independence. Today, Ukraine remains a post-genocidal society unable to fully regain its place in Europe because of the crippling legacy of its most recent past yet undeniably determined to reintegrate itself within the folds of European civilization.

Until 2004, political corruption, a seemingly weak civil society, declining birth rates, out-migration, and a failure to undo the consequences of Communism, coupled with resurgent Russian pretensions to Ukrainian territories, threatened the country's stability and even independence. Then, remarkably, following the Orange Revolution—massive, peaceful protests against fraudulent election results, coupled with unprecedented international attention focused on Ukraine—it became clear that despite the crippling legacy of living in a postgenocidal society, Ukrainians were united in wanting to recover their country's rightful place in Europe. And so, finally, freedom came to Ukraine.

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## United Arab Emirates

**Map Page** 1122 **Area** 32,000 square mi (82,880 square km) **Population** 2,484,818 **Capital** Abu Dhabi City **Highest Point** 5,010 ft (1,527 m) **Lowest Point** 0 m **GDP per capita** \$16,371 **Primary Natural Resources** petroleum, natural gas.



THE UNITED ARAB EMIRATES (UAE) is a federation of seven emirates in the Arabian Peninsula, established in 1971 (formerly six, the seventh acceded to the federation in 1972). The seven emirates (known as Trucial States)—Abu Dhabi, Dubai, Sharjah, Ajman, Umm al-Qaiwain, Ra's al-Khaimah, and Fujairah—are located along the Persian Gulf coast of the Arabian Peninsula. QATAR lies to the west, SAUDI ARABIA to the south and west, and OMAN to the and east.

Four-fifths of the land is desert. Towering dunes, rising to 656 ft (200 m), form part of the Empty Quarter, or RUB' AL-KHALI desert, at the southern border. To the northeast, the sand and gravel desert extends toward the jagged Hajar chain that splits the country from north to the south in the Northern Emirates. To the east is the solitary mountain of Jebel Hafit. Rocky slopes rise to 4,200 ft (1,300 m), falling steeply to the east coast where a fertile gravel plain borders the water of the Gulf of Oman. Sandy islets, sea grass beds, mangrove, khors (tidal inlets), and sandy beaches abound along its coast.

The UAE's main industrial activities, apart from the oil and gas sector, are construction, aluminum,

chemicals, plastics, metals, heavy equipment, food, clothing and textiles. The services sector accounts for 49.3 percent of employment.

Hydrocarbon reserves now stand at 97.8 billion barrels of oil and 212.1 trillion cubic ft (6 trillion cubic m) of natural gas, accounting for 12 percent of the world's total, with a crude oil production's daily average of 1,900,300 barrels. On the worldwide stage, these figures rank the UAE in fifth place in terms of size of its oil reserves and fourth with respect to its natural gas reserves.

Abu Dhabi has 94.3 percent of the UAE's total reserves; Dubai is focusing especially on development of trade, tourism, finance, and communications; Sharjah continues to focus on textiles and light industries; while other Northern Emirates have continued their investments in agriculture, ceramics, cement, and maritime industries.

A plan for Dubai's tourism expansion is based on 10 million people visiting Dubai as tourists by 2010, while passengers transiting by that stage is expected to exceed 30 million (70 million in 2020). Projects such as Dubai Internet City, D. Media City, and Techno Park will be joined by a financial "free zone." Dubai intends to construct the tallest tower in the world, exotic islands in the sea, a skier's paradise in the desert, and a hotel underwater. The UAE is one of the world's top breeding centers for Arabian horses.

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## United Kingdom

**Map Page** 1131 **Area** 94,526 square mi (244,820 square km) **Population** 60,094,648 **Capital** London **Highest Point** 4,406 ft (1,343 m) **Lowest Point** -13.2 ft (-4 m) **GDP per capita** \$25,300 **Primary Natural Resources** coal, petroleum, natural gas.





THE UNITED Kingdom of Great Britain and Northern Ireland (UK) is the full name of a state in western Europe composed of England, Scotland, and Wales on the island of Great Britain, plus roughly one-sixth of the island of IRELAND. The United Kingdom is also sovereign over the crown dependencies of the Isle of Man and the Channel Islands, and 13 former colonies, now known as Overseas Territories, around the globe.

These dependencies are the remnants of the largest global empire the world has ever seen, which, at its height in the late 19th century, covered roughly a fourth of the Earth's surface and included roughly a fourth of the world's population. Today, the British Empire has transformed itself into the British Commonwealth of Nations, of which the United Kingdom and its monarchy is the symbolic head. The United Kingdom itself has been transformed into a modern European state, with one of the strongest economies in Europe. Closer membership within the EUROPEAN UNION (EU) is still an issue in today's Britain, however, as is the constitutional relationship of the United Kingdom's component parts.

### NATIONS UNITED

As the name indicates, the United Kingdom is a state composed of more than one historic nation. The peoples of the island of Great Britain formed into several states in the early Middle Ages: the Germanic Angles and Saxons as England in the south, and the Celtic Scots and Welsh in the north and west. Wales was conquered by the English in 1284 and fully incorporated into the English legal and political structure by the Act of Union of 1536. Scotland defended its independence from the English for several centuries until 1603 when the Scottish king, James VI, inherited the English throne. One hundred years later, the parliaments of the two kingdoms merged by the Act of Union of 1707, and the Kingdom of Great Britain was formed.

Just to the west of Great Britain, the island of Ireland had its own language and culture, Celtic in origin, divided into four kingdoms. Starting in the 11th century, English kings began the conquest of Ireland, completed only in the 17th century. The Kingdom of Ireland was formally united to Great Britain in 1800, creating the United Kingdom of Great Britain and Ireland, which was modified to "and Northern Ireland" after the southern Irish counties became independent in 1922.

The six northern counties of Ireland with a Protestant majority chose to remain in the union, but decades later, tensions remain between those who wish to retain

this position and those who wish to join the Republic of Ireland. *Devolution* is a prevalent word in UK constitutional politics, as the component parts of the union reconsider their position with relation to the central government in London. New parliaments and assemblies were opened in 1999 in Edinburgh, Cardiff, and Belfast. Several regional assemblies for England, particularly in the far north, are also under consideration. As the European Union exerts its influence more and more over the British Isles, it is thought that these local governing bodies may press for even more autonomy.

### COLONIES ABROAD

Having limited natural resources, the British have relied on foreign trade since the Middle Ages. The growth of colonies abroad and the development of the INDUSTRIAL REVOLUTION at home stimulated tremendous economic growth in the 18th and 19th centuries. Following the heavy cost of two world wars and the Great Depression, the United Kingdom was forced to give up its empire, starting with INDIA and PAKISTAN in 1947. Today's British Commonwealth of Nations consists of 54 sovereign nations, some of which—like CANADA, AUSTRALIA, BAHAMAS, PAPUA NEW GUINEA, and TUVALU—retain the British monarch as head of state (16 in total), while others—such as India, NIGERIA, and FIJI—are republics. Still others are states with their own monarchs, such as MALAYSIA, TONGA, and LESOTHO.

The UK continues to control the foreign and defense affairs of 12 overseas territories: ANGUILLA, BERMUDA, the BRITISH INDIAN OCEAN TERRITORY, the British Virgin Islands, the CAYMAN ISLANDS, the FALKLAND ISLANDS, GIBRALTAR, MONTSERRAT, PITCAIRN ISLAND, ST. HELENA (and its dependencies, ASCENSION and Tristan da Cunha), SOUTH GEORGIA AND SOUTH SANDWICH ISLANDS, and the TURKS AND CAICOS ISLANDS. The Crown administers two other territories separately from the UK: the Isle of Man, located in the Irish Sea, between northern England and Ireland, and the Channel Islands (Jersey, Guernsey, and Alderney), located off the northwest coast of FRANCE.

Today, the UK has one of the world's five largest economies and is one of only four countries in western Europe whose gross domestic product (GDP) exceeds \$1 trillion. It is one of the busiest trading hubs and a major center for international finance, encouraged by its geographical position between Europe and North America, and its enduring strong ties with the developed and developing nations of the Commonwealth. By one estimate, London's traders control roughly 30 percent of all global foreign exchange trading. The UK

has a large agricultural sector, and an extremely efficient one, which means that only 1 percent of the country's labor force produces 60 percent of its food needs. Its largest crops are grains (wheat and barley), potatoes, and oilseed. Sheep and cattle are also ubiquitous in the British countryside, occupying about two-thirds of all agricultural land. The major export products of the UK include finished and semi-finished manufactured products, oil and natural gas, foodstuffs, chemicals, and motor vehicles.

Because of large reserves of North Sea oil, pumped since the 1970s, the UK is one of the EU's largest energy exporters, but it is also one of the world's largest energy consumers. Twenty-three percent of UK electricity is generated from nuclear power. There are projections of great potential for wave and tidal power, but this is so far unexplored. Coal mining and heavy industry have declined sharply since the mid-20th century, being replaced mostly by the service industry, particularly banking, insurance, and business services (nearly 75 percent of the GDP).

Tourism is also very important, catering to an average of 25 million visitors per year, though the business is suffering from increasingly inexpensive flights to sunnier climates of southern France and SPAIN. A large social welfare system built up in the aftermath of World War II has been partially dismantled in recent decades. Similarly, most state-owned companies, such as British Airways and British Telecom, have been privatized, although the government retains a large percentage of shares. Britain joined the European Union in 1973, but has been reluctant to go "all the way" and remains outside the common currency and some of the EU's common social and economic policies.

In general geographic terms, the United Kingdom is mainly composed of the island of Great Britain, one of the British Isles, which generally also include Ireland and the surrounding island groups of the Hebrides, the Shetlands, the Orkneys, the Isle of Man and the Isle of Wight. "Little Britain" refers to Brittany, across the English Channel in France. The term *Britain* is frequently used to refer to the UK, and the term *British* refers to its people.

The island of Great Britain is just under 620 mi (1,000 km) in length, from Dunnet Head on the north coast of Scotland to Lizard Point in Cornwall, and just under 300 mi (500 km) across its widest point from Wales to East Anglia.

Because Britain is an island, its history and culture have been heavily influenced by the sea. The UK has a total coastline of 7,706 mi (12,429 km), and with nu-

merous inlets and estuaries on all sides, no location is more than 78 mi (125 km) from the sea. Besides its frontier with the Republic of Ireland, the UK shares no other land borders. Its nearest neighbors—France, BELGIUM, NETHERLANDS, and NORWAY—lie across the North Sea and the English Channel. Since 1994, Britain has been connected to the mainland for the first time since the last Ice Age, via the Channel Tunnel.

The seas also affect the British climate, which is warmer than other countries of the world that are located at the same latitudes (London and Irkutsk, SIBERIA, for example, are both between 51 and 52 degrees N). The warm waters of the GULF STREAM bring warmer temperatures and a great deal of moisture from the tropics, particularly on Britain's western coasts.

Weather in the UK is unpredictable but has few extremes of temperature, rarely surpassing either 86 degrees F (30 degrees C) or 14 degrees F (-10 degrees C). On average, cloud cover and rain can be expected for 50 percent of the year in most locations. Highest rainfalls occur in the higher elevations on the western coast, including the Lake District and the Scottish Highlands, as well as the uplands of southern Wales, Devon and Cornwall. Extreme conditions range from the Isle of Wight, with an average of more than 8.5 hours of sunlight per day in summer, to the Scottish Highlands, with an average of less than half an hour of sunlight per day in December.

London is famous for its fog, but it is the area of lowland Scotland, between the Clyde and the Forth, that generally has the most fog. The far north of Scotland has the least fog, because of high winds and less pollution. Fog in general has decreased significantly all over the UK, following the reductions in air pollution since the 1960s. Britain's air currents are dominated by the warm Gulf Stream along the western coast, and cold Arctic air along the east coast. Where these two contrasting patterns meet, along the north coast of Scotland, the weather is frequently turbulent in the extreme.

Most of the United Kingdom is composed of rolling hills, with higher mountains in the western and northern parts of Great Britain, and some areas of flatland in the eastern parts of England. The following are the four component states of the United Kingdom.

## ENGLAND

In addition to having the largest area of the component states of the United Kingdom (50,854 square mi or 130,395 square km), England is by far the most popu-

lous. Its 49.5 million people comprise more than 80 percent of the total. England takes its name from the Germanic invaders of the 5th and 6th centuries, the Angles, though interestingly, the Celtic name for England (Sasana in Irish) derives from the other major invading group, the Saxons. The English population is thus made up of a mixture between the original Celtic inhabitants, Germanic and Nordic invaders, and later continental elements brought across the channel from France after the Norman conquest of 1066. And although Norman impact on the racial composition of the general English population was minimal, their dialect of French heavily influenced the creation of modern English. The resulting hybrid language is one of the most flexible languages in the world, lending itself well to its position as the leading international language in use today.

England is divided into a variety of regional, local and municipal governments, reflecting numerous changes, especially since World War II. Historically, England was divided into shires (counties). Thirty-four of these remain, with governing powers divided between county and district councils. More recent creations include six metropolitan county areas and 47 unitary authorities (*unitary* indicating a lack of division between county and district councils). England's historic shires and major unitary authorities (\*, created in 1974 but redivided in the late 1990s, thanks in part to the Restore Rutland campaign) include:

- Avon\* (divided into four unitary authorities, or UAs)
- Bedfordshire
- Berkshire (divided into West Berkshire\* and five UAs)
- Buckinghamshire
- Cambridgeshire
- Cheshire
- Cleveland\* (now divided into five UAs)
- Cornwall (including the Isles of Scilly)
- Cumbria
- Derbyshire
- Devon
- Dorset
- Durham
- East Sussex
- Essex
- Gloucestershire
- Hampshire
- Herefordshire\*
- Hertfordshire
- Humberside\* (now divided into East Riding of Yorkshire and three other UAs)
- Isle of Wight\*

- Kent
- Lancashire
- Leicestershire
- Lincolnshire
- Norfolk
- Northamptonshire
- Northumberland
- North Yorkshire
- Nottinghamshire
- Oxfordshire
- Rutland\*
- Shropshire
- Somerset
- Staffordshire
- Suffolk
- Surrey
- Warwickshire
- West Sussex
- Wiltshire
- Worcestershire

The six metropolitan counties are Greater Manchester, Merseyside (around Liverpool), South Yorkshire (around Sheffield), Tyne and Wear (around Newcastle), West Midlands (around Birmingham) and West Yorkshire (around Leeds). Set apart from these, Greater London maintains its own regional government, made up of the Cities of London and Westminster, and 32 boroughs (occupying most of the former shire county of Middlesex).

Since 2000, the Greater London Authority, including a directly elected mayor and assembly, has sought to integrate the administration of the city and its suburbs. London is England's capital, as well as the capital of the United Kingdom. With 7.2 million people in its metropolitan area, it is Western Europe's largest city, and one of the top 20 metropolitan areas in the world. Home to a large percentage of Britain's West Indian and South Asian population, it is one of the most colorful and culturally diverse cities in the world. Famous attractions range from the medieval fortress the Tower of London and the stately pomp of Buckingham Palace to the boisterous international markets along Portobello Road and the annual Afro-Caribbean festivities of the Notting Hill Carnival.

More recently, England has been divided yet again, this time into nine regions: North East, North West, Yorkshire and the Humber, East Midlands, East of England, London, South East, and South West. These regions put English local governments on par with the regional governments forming in several other EU na-



*Sometimes shrouded in fog, the Houses of Parliament in London have been the epicenter of the United Kingdom for centuries.*

tions, such as Spain and France. As larger self-sustaining economic units, they are increasingly responsible for their own regional affairs, and discussions are currently under way regarding devolution of political autonomy to them as well, in the same manner as Scotland and Wales in 1999. The first region to hold a referendum on this question was the North East in late 2004.

England's physical geography can be roughly divided in two by a line called the Tees-Exe Line, which stretches from the mouth of the River Tees in the far northeast to the River Exe on the southwest coast. West of this line, the countryside is hilly, with several ranges of low peaks aligned in a generally north-south direction. East of the line, England is increasingly flat, until it reaches the fens and marshes of East Anglia. Much of the soil in this eastern coastal area is composed of newer, alluvial soil and is thus the richest agricultural region of the United Kingdom. Canals and pumps have drained and reclaimed much of the fenland since the early Middle Ages, particularly in the lowlands around the large inlet known as The Wash.

English rock formations west of the Tees-Exe line are generally igneous and metamorphic, while east of the line, they are sedimentary. Western geological formations are complex and in strangely folded patterns, especially in Cornwall and Devon. This is thought to have been caused by the creation of the ALPS, which pushed up many of the ridges and folds that make up Britain's hill systems. There are great varieties of rock types and irregular features caused by differing degrees of resistance to erosion, such as the large granite mas-

sifs in the North Yorkshire Moor and Dartmoor in Devon. The southeast coast is famous for its chalk cliffs, particularly around Dover, ancient seabeds now raised hundreds of meters in the air.

Glaciation during the last Ice Age carved out deep valleys in the Cumbrian Plateau, creating one of England's one scenic natural areas, the Lake Country, containing England's highest peaks (the Cumbrian Fells, including Scafell Pike, 3,227 ft or 978 m), as well as its only significant lakes (Derwent Water, Ullswater, and Windermere). The peaks of the Lake Country form the northern end of the long range of mountains known as Britain's "spine," the Pennines, which also include the Peak District and the Yorkshire Dales. Further south are lower ridges: the Cotswolds, the Chilterns, and the North and South Downs.

England's main lowland valley is the Thames Valley, which flows for 150 mi (239 km) from the Cotswold Hills in the west past the most quintessentially English countryside and the historic cities of Oxford and London before entering the North Sea through the wide Thames estuary. Other major rivers include the Trent and the Great Ouse, which also flow toward the east. The only major river system to flow toward the west is the Severn, the UK's longest river (200 mi or 322 km), which rises in central Wales and empties into a large estuary, the Bristol Channel. The Trent and Northern Ouse together form the Humber Basin, the UK's largest drainage system, covering 9,750 square mi (25,000 square km) of east-central England. The Thames River and estuary drains 5,850 square mi (15,000 square km).

Almost all the rivers in England have been completely canalized—a network of English canals was completed just in time to become nearly obsolete by the invention of the locomotive. The earliest canals provided the cheap transportation of raw materials essential for the genesis of the Industrial Revolution in the British Midlands. Heavy industry was concentrated in the Midlands in the 19th century, creating almost overnight the cities of Birmingham, Manchester, Sheffield, and Leeds, today the UK's four largest cities after London. These cities were built in proximity to the coalbeds and to the thriving Atlantic ports of Liverpool and Bristol. Other large coal exporting cities were located on the eastern coast, notably Newcastle and Hull.

Older ports along the coast of the English Channel include Dover, Portsmouth, Southampton and Plymouth. Today England is still highly urbanized in some parts of the Midlands and the south, notably around



greater London. Air and water pollution remains a problem in some of these areas, as well as oil pollution in some of the port cities. More seriously damaging, however, are acid rains that are carried north from England's industrial south that fall on the forested slopes of northern Wales and southwestern Scotland.

## WALES

The name *Wales* is not Celtic, but a Germanic word meaning foreigners (similar to the names given to other non-German-speaking areas of Europe: Wallonia and Wallachia). The Welsh name for their country is *Cymru*, meaning "friends" or "countrymen."

Out of a total population of just over 2.9 million, roughly 70 percent have no knowledge of Welsh and only about 5 percent use it as their primary language, mostly in rural areas of the far west. The Principality of Wales has been legally merged with England since the 16th century, but a majority of its people continued to speak Welsh until the 19th century. Welsh language schools were established in the 1980s, and the number of children learning Welsh is increasing each year, aided by a Welsh language television station and a Welsh language university at Aberystwyth. The title Prince of Wales has been given to the eldest son of the British monarch since the 14th century, but most Welshmen see little relevance to their history and culture (despite the elaborate ceremony staged at Caernarvon Castle in 1969), and the prince has no role in actual governance of the country. Wales is still primarily a land of light agriculture and herding, with some concentrations of heavy industry in the south.

Physically, Wales is almost entirely mountainous. The main range, known as the Cambrian Mountains, runs from north to south. To the northwest of the main range lie the mountains of Snowdonia, the only area showing evidence of volcanism, including the highest peak in Wales, Mount Snowdon (*Yr Wyddfa*), at 3,581 ft (1,085 m). The Cambrian Mountains, which derive their name from the same word as *Cymru*, are largely carboniferous and rich in coal. The southern valleys of Wales were heavily populated during the 19th century to mine and process this coal and have suffered greatly since the closure of a majority of the collieries in the 1980s.

An earthwork wall, Offa's Dyke, was built on the eastern edge of these mountains by an early Anglo-Saxon king to keep out the Britons living to the west. It was the earliest boundary between what were to develop into England and Wales. Today's border is formed in part by two of Wales's major rivers, the Wye



*Stonehenge in the United Kingdom dates to 3100 B.C.E. Speculations about its purpose range from human sacrifice to astronomy.*

in the south and the Dee in the north. The coastline of Wales is one of its primary natural attractions, including numerous rocky bays, peninsulas, and cliffs. Immediately off the northwest coast is the large island, Anglesey ("Island of the Angles").

Wales was divided into historic counties (mostly decided by the English) and given a national capitol, Cardiff (*Caerdydd*), in 1955. Cardiff grew into a large city based on exports of coal in the 19th century, as did Wales's two other large cities, Swansea and Newport. About two-thirds of the population live in the southern valleys and coastal areas of South Wales.

Starting in 1974, Wales was divided into eight counties: Clwyd, Dyfed, Gwent, Gwynedd, Mid Glamorgan, Powys, South Glamorgan, and West Glamorgan). In 1996, Wales was redivided into 22 unitary authorities (similar to the English unitary authorities), including nine counties, 10 county boroughs, and five cities:

- Cardiganshire (*Gaerfyrddin*)
- Ceredigion
- Conwy
- Denbighshire (*Ddinbych*)
- Flintshire (*Fflint*)
- Gwent (today divided into five UAs)
- Gwynedd
- Glamorganshire (*Morgannwg*, divided into six UAs)
- Isle of Anglesey (*Ynys Mon*)
- Monmouthshire (*Fynwy*)
- Pembrokeshire (*Benfro*)
- Powys
- Wrexham (*Wrecsam*)

Wales remains one of the least developed parts of the United Kingdom, with over 25 percent of the land designated as a National Park or Area of Outstanding Natural Beauty. Particularly attractive are the Brecon Beacons and the Pembrokeshire coast.

## SCOTLAND

The Scottish kingdom was formed by the joining of several major lowland clans in the 9th and 10th centuries and the gradual absorption of the more independent-spirited Highland clans in the following centuries. Anglo-Norman influences from the south influenced the government, language, and culture of the Lowlands from the 12th century, leading to centuries of warfare over borders and Scottish independence. The Highland clans were not entirely subdued by the English (and indeed by the other Scots) until the middle of the 18th century, but the following century saw the rise of Scottish culture as one of the major fads in Victorian Britain.

Kilts and bagpipes and summer homes in the Highlands were seen as very fashionable in London society, aiding the Scots in their integration into the union as a whole—by the end of the 19th century a significant percentage of Britain's colonial administrators and military commanders came from Scotland. Today, Scotland retains its own sense of heritage—Scottish legal and educational systems differ significantly from the rest of Britain—and despite the devolution of a high degree of local autonomy with the restoration of the Scottish Parliament in 1999, calls for outright independence from the UK within the EU are louder here than anywhere else.

The 5 million people who live in Scotland comprise only 8.5 percent of the total UK population. Its land area of 30,725 square mi (78,782 square km) gives Scotland the lowest population density in the UK and one of the lowest in Europe. Three-quarters of the population live in the central Lowlands, where Scotland's two largest cities are located: Glasgow (577,000) and Edinburgh, the capital (448,000). Stirling is also a major city in the central Lowlands. Scotland's three other large cities are located in the Lowland areas along the eastern coast of Scotland: Aberdeen, Inverness, and Dundee.

Scotland, like England and Wales, was traditionally divided into shire counties, particularly in the Lowlands, where English language and culture predominated. In 1974, the country was divided politically into twelve regions: Borders, Dumfries and Galloway, Strathclyde, Lothian, Central, Fife, Tayside, Grampian,

Highland, Western Isles, Orkney, and Shetland. Since the 1990s, these have been redivided into 32 Council Areas, many returning to the names of their former county shires:

- Aberdeenshire (and Aberdeen City)
- Angus (and Dundee City)
- Argyll & Bute
- Ayrshire (East, North, and South)
- Clackmannanshire
- Dumfries & Galloway
- Dunbartonshire (East and West, and Glasgow City)
- Eilean Siar (formerly known as Western Isles, or the Outer Hebrides)
- Falkirk
- Fife
- Highland
- Inverclyde
- Lanarkshire (North and South)
- Lothian (West, Mid, and East, and the City of Edinburgh)
- Moray
- Orkney Islands
- Perth & Kinross
- Renfrewshire (and East Renfrewshire)
- Scottish Borders
- Shetland Islands
- Stirling

The Highlands district is by far the largest of these districts, but the least populated. Its chief town is Fort Williams, in the shadow of Scotland's (and the UK's) tallest peak, Ben Nevis (4,406 ft or 1,343 m). The surrounding areas of Scotland have some of the oldest rocks in Europe. The Caledonian Highlands and the islands of the Hebrides are geologically related to GREENLAND and the CANADIAN SHIELD, to which they were joined nearly 200 million years ago. At that time, Scotland and North America were joined together, while England and Wales were joined to the European continent. The gap between them closed only around 20 million years ago. This tectonic activity also caused some volcanism in western Scotland, leaving behind basalt formations on some of the western isles, like Mull and Skye. Other islands included within the broader term of Inner Hebrides are Islay, Jura, Tiree, Coll, Eigg, Canna, and the famous monastic island of Iona.

Across the channel known as The Minch lie the Outer Hebrides, consisting mainly of the Isle of Lewis, North Uist, South Uist and Barra. The islands of Arran and Bute are also off the western coasts, in the broad

bay known as the Firth of Clyde. A *firth* is the Scots term for a bay or fjord, while *loch* is the Scots term for lake. Scotland's thousands of firths and lochs are the result of heavy glaciations during the last several periods of Ice Age. Many of the gouges cut by glaciers and now filled by lochs are quite deep, including the deepest lake in the UK, Loch Morar (1,023 ft or 310 m). Other lochs well known for their scenic beauty include Loch Fyne, Loch Shiel, and Loch Lomond. Loch Ness is one of the longest lochs and is famous for its mythical sea creature but is not particularly scenic.

Scotland has three major regions of mountains: the Highlands, the Grampians (including the Cairngorm Mountains) and the Southern Uplands, which include the Cheviot Hills, a dividing line between Scotland and England. Hadrian's Wall formally signified this border, running roughly from Solway Firth to Tynemouth. The wall was built by the Romans in 122 C.E. to keep out the Celtic barbarians of the north (similar to Offa's Dyke in Wales) and remains a chief tourist attraction for the region. The Highlands are full of glens, narrow valleys between mountain peaks, known as bens. One of the most famous of these is Glen Coe, known for its stark, barren landscape and for the massacre of most of its residents (the MacDonalds) by Clan Campbell in 1692. Visitors come to the Highlands, mostly in summer, for extraordinary hiking and natural solitude. Aside from tourism, the major economic activity of the Highlands is sheepherding and wool-related industries.

The Lowlands are mainly concentrated in a band across central Scotland, from the Clyde estuary to the Firth of Forth. This is the center of much of Scottish population, as well as much of its history and nearly all of its industry. This depression between the Highlands of the north and the Southern Uplands is possibly an ancient fault line. The same could be true for the long narrow valley that nearly bisects the Highlands, from the Firth of Lorn and the town of Fort William in the west to the city of Inverness and the Moray Firth in the east. This valley, known as Glen Mór (the "Great Glen"), includes Loch Ness and is navigable from end to end via the Caledonian Canal. The Forth & Clyde Canal similarly connects the west and east coasts in central Scotland.

Scotland's major rivers include the Clyde, the Tay and the Tweed, which forms part of the border with England. The River Tay has the second largest discharge of any river in the UK, after the Humber, at 5,648 cubic ft (160 cubic m) per second. Other rivers are the Ayr, the Don (which gives its name to Aberdeen), and two rivers called Dee.

Scotland's outer islands—the Hebrides, Shetlands, and Orkneys—have a bit more local authority than other local governments. For example, Shetland controls oil development in its own waters. The Orkneys consist of the Mainland and several smaller islands. Shetland (or Zetland) is similarly composed of the Mainland and several smaller islands, the northernmost called Unst, with Britain's northernmost post office, Haroldswick.

About 300 mi (480 km) northwest of the Hebrides, in the North Atlantic, rises the summit of an extinct volcano, about 83 ft (25 m) wide at its base and approximately 72 ft (22 m) tall. This is Rockall, which is currently claimed by the UK, mostly for the exclusive rights sovereignty would convey to the valuable seas around it. Its status is disputed with Ireland, DENMARK, and ICELAND, and it has also been symbolically claimed by the environmental activist group Greenpeace (which occupied the tiny rock for a short time in 1997, renaming it Waveland) as a protest against oil exploration.

## NORTHERN IRELAND

The territory now known as Northern Ireland (Tuaisceart Éireann in Irish), was historically known as Ulster, one of the four historic provinces of Ireland. When the southern 26 counties of southern Ireland left the union in 1921, the northern six counties—mostly populated by Protestants—opted to remain a part of the United Kingdom. The six original counties (Antrim, Armagh, Down, Fermanagh, Tyrone, and Derry) have today been replaced by 26 District Council Areas (equivalent to unitary authorities in England and Wales). Belfast, population 274,000, is the capital and major city. Other cities include Derry, Armagh, Newry and Lisburn.

Northern Ireland occupies about one-sixth of the area of the island of Ireland, covering 5,399 square mi (13,843 square km) and sharing the UK's only land boundary with another member of the EU. Its 1.7 million people speak mostly English but also maintain a tradition of speaking the local dialects of Irish Gaelic and Ulster Scots (a dialect of English brought over by Scottish settlers in the 17th century). Belfast has a large Chinese immigrant population, making Chinese the second-largest language group after English.

Most of the population is divided religiously and politically between a Protestant majority who are mostly Unionist (favoring continued membership in the United Kingdom) and a Catholic minority who are mostly (but not entirely) nationalist (favoring union with the Republic of Ireland). Tensions emerging from



this divide became violent between the 1960s and 1990s, the period known as “The Troubles,” and although quieter in the mid-2000s, the conflict has yet to be fully resolved.

The landscape of Northern Ireland consists mostly of low hills. There are two areas of low mountains: the Mourne, from South Down to Strangford Lough in the east, and the Sperrins in the northwest. The Mourne are granite massifs, with deposits of gold, and include the highest point in Northern Ireland (Slieve Donard, 2,798 ft or 848 m). The northeast, in Antrim, is also significantly hillier, the result of ancient volcanism that has left behind one of the most interesting geologic features in the United Kingdom, the Giant’s Causeway.

These geometric pillars face the North Channel, which separates Ireland from Scotland at the nearest point by only 13 mi (21 km). Much of the center and western part of Northern Ireland are lowlands, much of this occupied by several large lakes, including the largest lake in the UK, Lough Neagh (153 square mi or 396 square km), and the long series of lakes, Upper and Lower Lough Erne, the waters of which ultimately flow out into the Atlantic through County Donegal in the Republic of Ireland. The rivers Bann and Blackwater feed Lough Neagh, but only the Bann flows out the other side. Other important rivers include the Foyle on the northwest border and the Lagan, which flows through Belfast into the Belfast Lough.

Northern Ireland had its own parliament from 1921 to 1973, when it was suspended because of The Troubles. The struggles began as Catholic minority protests against discrimination in housing and jobs and representation in government. Much of the violence was led by the Irish Republican Army (IRA) and its political wing, Sinn Féin. The death toll since 1969 has surpassed 3,600.

In April 1998, the Good Friday Agreement was signed, which created a new Northern Ireland Assembly and called for formal cooperation between the governing institutions of Northern Ireland and the Republic of Ireland. The assembly was created in 1999, but its history has been rocky, and direct rule from London was instituted once again in October 2002. New elections were held in November 2003, but the assembly remained suspended.

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## United States

**Map Page** 1142 **Area** 3,717,813 square mi (9,629,091 square km) **Population** 290,342,554 **Capital** Washington, D.C. **Highest Point** 20,321 ft (6,194 m) **Lowest Point** -282 ft (-86 m) **GDP per capita** \$37,800 **Primary Natural Resources** coal, copper, lead.



THE UNITED STATES is a country in North America bordered by CANADA to the north, MEXICO to the south, the PACIFIC OCEAN to the west, and the ATLANTIC OCEAN to the east. There are five predominant topographical areas within the continental United States.

The APPALACHIAN MOUNTAINS, a chain of interconnected low-lying mountain ranges that were carved by glacial activity, span the eastern United States from MAINE to GEORGIA. Aside from the mountains, the northeastern United States terrain consists of low-lying land with rocky coastline, swamps, forests, and farmland.

The mid-Atlantic (from NEW JERSEY to VIRGINIA) region includes a series of coastal inlets, farmland, and low hills. The southeastern United States includes the Ozark and Great Smoky mountain ranges as well as hilly regions and farmland. The southernmost section of the region consists of expansive low-lying swamps.

The midwestern United States, which is predominantly made up of flat plains, is divided by the MISSISSIPPI-Missouri-Ohio river system, which is the most expansive river system in the United States at 3,740 mi (6,020 km) and an important source of transportation for the shipping industry. The northern part of the region consists of flat prairies. The region becomes in-



creasingly more arid moving from the north to the south.

The northwest is spanned by the Cascade and Alaskan mountain ranges, which includes Mount MCKINLEY, the highest point in the United States. Like the Appalachian Mountains, many of the northwestern mountains were carved by glacial activity, although they are much newer than the mountains in the east, as evidenced by their more rugged peaks. Some of the mountains, such as WASHINGTON state's Mount St. Helens, are the result of volcanic activity. Some of the volcanoes, including Mount St. Helens, are still active, although there are several dormant and extinct mountains in the area. The region also includes rocky coastline, and is heavily forested, supporting a thriving lumber industry.

### RING OF FIRE

The southwestern terrain is a blend of mountain and desert, which includes the ROCKY, Santa Lucia and Sierra Nevada Mountains as well as Death Valley, which is the lowest and hottest geographic point in the United States. The southwest is also the home of the famous GRAND CANYON, which was carved by the Colorado River. Parts of southern CALIFORNIA, COLORADO, and UTAH include expansive forests. In addition, the western coast is part of the western rim of the Pacific RING OF FIRE, a region of extraordinary volcanic activity. Several natural fault lines along the western coast also make the region prone to earthquake activity and tsunamis.

Outside of the continental United States are the states of HAWAII and ALASKA. The state of Hawaii, which is approximately 3,000 mi (4,828 km) off the western coast of the mainland United States, consists of a chain of islands, including the five main islands—Oahu, Maui, Lanai, Kauai, and Hawaii (the big island)—and 124 smaller islands.

The island topography consists of a blend of volcanic mountains, rainforests, and beaches. The islands of Hawaii and Maui are home to the infamous volcanic mountains, Haleakela, a dormant volcano whose last eruption occurred in the middle of the 18th century, and Kilauea, an active volcano. The islands are also home to hilly farmlands, thick rainforests and sandy beaches, including the famous black sand beaches. The waters surrounding the islands are home to large coral reefs, atolls, and underwater volcanic craters, such as Maui's Molokini crater, home to an array of tropical marine life. The waters drop off quickly with several currents and riptides. During the

months of November through March, the waters rise, producing some of the tallest waves in the world, a lure for surfers.

The state of Alaska consists mostly of rugged mountainous terrains carved by glacial activity. The terrain renders travel by road difficult in many places and impossible in others, particularly in the arduous Alaskan winters. Transportation, particularly between the more remote villages, is largely dependent on bush pilots. During the warmer months, the Kuskokwim River serves as a shipping lane from the Bering Sea up to Bethel, Alaska. Further north, into the Yukon Delta, the terrain flattens out and consists largely of tundra.

### CLIMATE

The United States climate varies by region. The Southwest is generally hot and arid, with temperatures reaching over 100 degrees F (37.7 degrees C) in the desert during the summer. The dryness renders the forests of the southwest (particularly in southern California and Colorado) prone to large forest fires during the summer and fall. The southwestern mountain ranges, such as the Rocky Mountains, are prone to afternoon thunder storms in the summer and are cold with heavy snow in the winter.

The Great Plains of the Midwest tend toward semi-arid, increasingly hot and dry toward the south. The region is home to "tornado alley," an area subject to seasonal tornadoes. The Northwest is generally temperate, receiving a lot of precipitation year round. The Northeast temperatures vary widely; cold and snowy in the winter and hot and humid in the summer, with temperatures breaking 90 degrees F (32 degrees C).

Outside the continental United States, Hawaii has a tropic climate almost year-round. Winters tend to milder and rainy. Alaska has an arctic climate. In southern Alaska, temperatures may reach the 70s degrees F (20s degrees C) during the summer. The winters usually consist of sub-freezing temperatures, snow, and reduced sunlight in the southern part of the state (complete darkness for months at a time in the north).

### GOVERNMENT

The seat of the federal government in the United States is Washington, D.C. Designed by French architect Charles L'Enfant, the city is laid on a grid and is bordered along the south by the Potomac River. Washington, D.C., remains the home of any sitting U.S. president for the duration of his or her four-year term. It is also the home of the Supreme Court, the Senate, and the House of Representatives, which make up the

judicial and legislative branches of the U.S. federal government.

The United States is divided into 50 administrative states (capitals are listed in parentheses): ALABAMA (Birmingham), Alaska (Juneau), ARIZONA (Phoenix), ARKANSAS (Little Rock), California (Sacramento), Colorado (Denver), CONNECTICUT (Hartford), DELAWARE (Dover), FLORIDA (Tallahassee), GEORGIA (Atlanta), Hawaii (Honolulu), IDAHO (Boise), ILLINOIS (Springfield), INDIANA (Indianapolis), IOWA (Des Moines), KANSAS (Topeka), KENTUCKY (Frankfort), LOUISIANA (Baton Rouge), Maine (Augusta), MARYLAND (Annapolis), MASSACHUSETTS (Boston), MICHIGAN (Lansing), MINNESOTA (St. Paul), MISSISSIPPI (Jackson), MISSOURI (Jefferson City), MONTANA (Helena), NEBRASKA (Lincoln), NEVADA (Carson City), NEW JERSEY (Trenton), NEW HAMPSHIRE (Concord), NEW MEXICO (Santa Fe), NEW YORK (Albany), NORTH DAKOTA (Bismarck), OHIO (Columbus), OREGON (Salem), OKLAHOMA (Oklahoma City), PENNSYLVANIA (Harrisburg), RHODE ISLAND (Providence), SOUTH CAROLINA (Columbia), SOUTH DAKOTA (Pierre), TENNESSEE (Nashville), TEXAS (Austin), UTAH (Salt Lake City), VERMONT (Montpelier), VIRGINIA (Richmond), WASHINGTON (Olympia), WEST VIRGINIA (Charleston), WISCONSIN (Madison), and WYOMING (Cheyenne).

Each state is headed by an executive branch, which includes a governor and a lieutenant governor, who are popularly elected on the same ticket every four years. Each state also has a house of representatives, senate, and a supreme court.

In addition to the 50 states, the United States has several dependent areas: American Samoa, Baker Island, GUAM, Howland Island, Jarvis Island, Johnston Atoll, Kingman Reef, Midway Islands, Navassa Island, NORTHERN MARIANA ISLANDS, Palmyra Atoll, PUERTO RICO, VIRGIN ISLANDS and Wake Island. Inhabitants of some of these areas, such as American Samoa, the U.S. Virgin Islands, and Puerto Rico, are United States citizens. Puerto Rico, a commonwealth of the United States, has been considered for statehood on several occasions, but Puerto Ricans thus far have voted to retain the island's current status.

## ECONOMY

The early American economy was an agricultural, mercantile economy. Although some men near larger cities were apprenticed in order to learn a trade, the majority of the settlers were farmers. With the availability of more open land and a longer and more temperate growing season, agriculture was particularly important

in the southern colonies, such as Virginia. Settlers grew and sold cash crops such as indigo, tobacco, and wood to Britain, which would process the raw materials and sell the finished product back to the United States at considerable profit. Boston and NEW YORK CITY were the largest and most active ports, even after the American Revolutionary War. Prior to the American Revolutionary War, there were many restrictions on trade that prevented the settlers from engaging in free trade with nations other than Great Britain.

New cash crops such as sugar and cotton (following the invention of the cotton gin) created an increasing demand for cheap labor and created a boon for the Trans-Atlantic slave trade. It also created a demand for more cultivatable lands, and by the early 19th century, the United States began to look to expansion westward. This expansion led to clashes with the native tribes to whom these lands had long been home as well as clashes with FRANCE and SPAIN, two other European powers with colonizing interests in the New World.

Industrialization began in the early 19th century with northeastern manufacturing plants, such as the textile mills of Lowell and Lawrence, Massachusetts. Mining followed as a second major American industry, with major coal mines in Pennsylvania and gold, silver, and later zinc mines in the west.

As it moved into modern times, the U.S. economy has come to support a diverse number of industries throughout the country. A large forestry industry exists in the Pacific Northwest. Oil drilling exists in the southwest (Texas, Oklahoma, and Nebraska) as well as in Alaska.

Agriculture still remains the predominant industry in the Midwest, which is also known as “the heartland” and “the nation’s bread basket.” Wheat and corn are among the most common crops that are grown on a large scale, but the central United States is also home to a lot of the nation’s dairy farms. Wisconsin locals are known as “cheese heads” because of their state’s large cheese production. Additionally, in points both further south and west (in Texas, Oklahoma, Wyoming, Nebraska, and Montana) are the cattle farms that produce most of the nation’s beef.

California is home to a variety of agricultural ventures, including the vineyards of Napa and San Fernando valleys and farms that produce grapes, artichokes and other crops that thrive in a more Mediterranean climate. The California locale of Simi Valley (or Silicon Valley) is home to many of the United States premier information technology firms. Southern California is home to the bulk of the United States’

thriving entertainment (film, music, and television) industry.

The northeast of the country remains relatively industrial, although parts of New Hampshire, western Massachusetts, Connecticut, and Vermont include smaller (mostly dairy) farms and fruit orchards. With the exception of Boston, Massachusetts, most major northeastern cities have large manufacturing plants. Boston is the host to several biotechnology firms.

Trade with foreign markets in Europe and Asia is at the heart of American industry. New York, on the East Coast, and Los Angeles, on the West Coast, are probably the nation's two busiest ports for shipping and receiving overseas goods. An increasing number of manufacturing and technical jobs are also being sent overseas, where corporations may find fewer restrictions and lower labor costs and taxes.

Finally, the United States has a large tourist industry. In the Northeast, the beaches, museums, historic sites and fall foliage are the major draws, with the peak tourist season occurring between mid-June and early October. Beaches and the boardwalks and casinos of Atlantic City and Ocean City are a significant draw in the mid-Atlantic states.

In the South are more beaches, and golf courses, and there are several large theme parks in Florida. The peak tourist season in the South occurs February through April. In Colorado and Utah, the ski industry makes up the bulk of the tourist industry. Ski season can begin as early as late October and quite frequently runs into early May. Additionally, Colorado receives a significant number of campers and hikers during the summer and early fall. The beaches of the southwestern coast and several other theme parks draw tourists throughout the year. Finally, Hawaii's tropical climate draws crowds year-round.

## HISTORY AND GEOGRAPHIC EXPANSION

Archaeologists speculate that the first settlers crossed into North America via a now-defunct LAND BRIDGE between SIBERIA and Alaska approximately 10,000 to 30,000 years ago. These people disseminated throughout North America and evolved into multiple native cultures.

The first European settlers began to arrive in what would become the United States as early as the 16th century. Spanish explorer Ponce de Leon created the first settlement in Florida in 1519. The French claimed lands in the northeast, in what is now the Great Lakes region, and in the south, including what is now Louisiana. The French settlers established a fur trade,

while the Spanish established plantations in which they initially utilized Native Americans as slaves and later brought in African slaves.

English explorer Sir Walter Raleigh and the Virginia Company made the first attempt at an English settlement on Roanoke Island in 1584. The colony was a failure. Raleigh returned to England for supplies for the struggling colony, but when an expedition returned several years later, the colonists had vanished leaving only the word "Croatan" carved into a tree. The fate of the colonists remains a mystery.

The first successful English colony was established by Pilgrim separatists, who had left England because of dissent from the Anglican Church. The Pilgrims arrived at Plimouth (now called Plymouth, Massachusetts) via a ship called the *Mayflower* in 1620. Gradually, more English settlers arrived, peopling what would become the United States. Some of these settlers created communities in Connecticut and Rhode Island in opposition to the strict theocratic society set up by the Puritans. The settlements expanded, creating tensions that flared between them and the European settlers. There were also tensions between the colonizing powers, culminating in conflicts such as the French and Indian War of 1763.

In addition to conflicts with other European powers and natives, English settlers grew increasingly dissatisfied with the royal governance. The original 13 colonies that became the United States declared their independence from Great Britain on July 4, 1776, following rising tensions over taxation and representation. This declaration of independence led to the American Revolutionary War. The first shots of the war were fired at the Battle of Lexington, when Paul Revere took his famous ride to warn the colonists that the British army was coming. Supported by French troops, the colonial troops, who were known as the Continental Army, ultimately defeated the British and their Hessian (German) mercenaries. The American Revolutionary War officially ended in 1783, with the Treaty of Paris.

The 19th century was an age of geographic expansion for the United States. Vermont, Kentucky, Tennessee, and Ohio joined the Union within the country's first few formative years. In 1803, the country's third president, Thomas Jefferson engineered the purchase of the Louisiana territories (LOUISIANA PURCHASE) from France, an event that more than doubled the geographic expanse of the United States. Realizing that he could not spare troops to defend the territory and needing more money to support his military actions in

Europe, Napoleon Bonaparte decided to offer to sell to America the Louisiana Territory, an 800,000-square-mi (2,000,000-square-km) tract of land that stretched from the Mississippi River to the Rocky Mountain range to what was then the western United States. Although initially suspicious of France's motives, after nearly two years of discussion and negotiation with France, President Jefferson was elated to discover that the United States would gain not only a large amount of land, but also control of the full length of the Mississippi River. Meriwether Lewis, who had served as a secretary-aide to Jefferson for two years, was selected by Jefferson to lead an expedition to explore the newly acquired land. Upon accepting this appointment, Lewis wrote and asked William Clark to join him. Once Clark had accepted the offer, the two men embarked on their exploration from what is now Hartford, Illinois, on May 14, 1803. LEWIS AND CLARK were joined by a crew of 45 men in order to help porter supplies and a large, armed keel boat.

The Lewis and Clark Expedition took three years and covered 3,700 mi (approximately 5,955 km) through what is now Illinois, Missouri, Kansas, Iowa, Nebraska, South Dakota, North Dakota, Montana, Idaho, Oregon, and Washington State.

### MANIFEST DESTINY

This expansion brought about a sense of Manifest Destiny, a notion that supported westward expansion as being sanctioned by God. The western frontier was often romanticized in popular culture as a mecca of open space and wild independence as the acquisition of land continued. With both the emigration of the U.S. population ever more westward and the country becoming increasingly more industrial, public interest grew in having the means to transport people and goods quickly, safely, and reliably.

By 1841, settlers moved across the northern Great Plains (including the Dakota and Kansas Territories), in what became known as the Oregon Trail. The trail ran from the borders of Missouri and Iowa, through Nebraska, Kansas, Wyoming, Idaho, and up to the border of Oregon and Washington State. Most of the settlers moved along either by foot or in caravans of covered wagons, across wide, hostile rivers and across rocky, mountainous ledges. Approximately one in ten travelers died en route from disease, starvation, attack, or accident, but the Oregon Trail remained the best route westward.

The United States purchased Texas and surrounding lands in 1848, adding to the growing country.

President James Polk's announcement that gold had been discovered in the Oregon Territory heightened interest in westward expansion, and in 1850, California, which was also rich in gold, became the 30th state. The famous Comstock Lode in Nevada nine years later lured still more would-be prospectors westward and aroused interest in finding a route across the jagged peaks of the Sierra Nevada Mountains.

The lure of gold and silver in the west helped to mitigate the sectionalism and regional interests that had stalled many earlier discussions about building a railroad. The Central Pacific Railroad Company was established in 1860 and following two years of surveys and lobbying, President Abraham Lincoln and Congress passed the Pacific Railroad Bill, which provided financial support and land for the building of multiple railroads.

The Central Pacific and Union Pacific Railroad Companies began their separate railroad lines in 1863, with the Central Pacific beginning in California and the Union Pacific beginning in Nebraska. Construction of the railroads caused the flare of tensions between those associated with the railroads and the natives through whose lands the lines passed.

Construction of the railroads moved very slowly, sometimes only inches a day in mountainous areas where the route needed to be carved through the mountains. After years of labor issues, construction setbacks and quibbling between the two railroad companies, the Union Pacific and the Central Pacific, with their engines nose to nose, came together in 1869 to drive a golden spike, which serves as a symbolic unification of the United States. In addition to this symbolic unification, this transcontinental railroad provided a means by which the United States could move freight and transport people, thus acting as a catalyst for the further expansion, mobilization and industrialization of the country.

The United States purchased additional territory with the Gadsden Purchase of 1853. Overall, this expansion led to further tensions with the natives as settlers began to encroach on their lands, leading to violence on both sides. Controversy erupted over the so-called Indian problem, as there were multiple ideas of how to handle these tensions. Some argued for the forcible assimilation of natives into western Euro-centric society, believing Christianity and a written culture to be hallmarks of a civilized society. Some Native American cultures, most notably the Cherokee people, were highly successful in adopting European culture. They developed their own system of writing based on



the Cherokee language, created a school system and wore European dress.

Through the political turmoil of the Civil War and the subsequent Reconstruction, the United States continued to expand geographically. In 1867, the United States purchased Alaska from Russia, when Secretary of State William H. Seward signed an agreement with the Russian minister to the United States, Baron Edouard Stoeckl, where Russia ceded the Alaskan Territory to the United States for a sum of \$7.2 million. This much-ridiculed agreement became known as “Seward’s Folly,” as there was little public interest in the land. Alaska remained governed by the navy until 1884, when the Organic Act was signed, making the territory a civil and judicial district.

In 1893, the United States annexed Hawaii, under the pressure of the wealthy and powerful sugar plantation owners. Additionally, the islands were in a geographically strategic location in terms of military and shipping. In 1959, both Alaska and Hawaii became the 49th and 50th states, respectively. As commercial air travel became more common in the mid-20th century, Hawaii became the subject of an intense marketing for tourism.

The United States has remained geographically stable for decades, although there is still some speculation that Puerto Rico may one day elect to become the 51st state. Throughout its growth, the United States became a major world power and retained military presences and small commonwealths and protectorates around the globe. As it moves into the 21st century, the degree of influence the United States has around the world is the subject of some controversy.

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## Ural Mountains

THE URALS EXTEND over 1,553 mi (2,500 km) from the ARCTIC OCEAN to the steppes of KAZAKHSTAN. The territory of nearly 318,148 square mi (824,000 square km) is subdivided in the *oblasti* (districts) of Perm, Cheliabinsk, Kurgansk, Orenburg, and the Autonomous Republics of Udmurtia and Bashkiria. The Ural highlands, with the highest peak of Narodnaya (6,213 ft or 1,894 m), separate the East European plains from the west Siberian lowlands.

From the north to the south, the mountains touch different climatic zones. In the TUNDRA of the polar Urals (Poliarnyi Ural) the winter lasts nearly seven months. The summer in the southern Orenburg district is almost dry, similar to nearby Kazakhstan. Since the Urals—far away from the ATLANTIC OCEAN—lie in the heart of the Eurasian continent, a continental climate is characteristic for the region. In winter, temperatures can go down to -40 degrees F (-40 degrees C) in the southern areas, and to -76 degrees F (-60 degrees C) the north. In summer temperatures in the steppe zone can go up to 104 degrees F (40 degrees C).

In the north, the Urals are exposed to cold winds from the polar sea, and in the south to hot steppe winds from central Asia. As such, the highlands of the Urals present a transition zone.

The Urals are rich in iron deposits. Industrialization of the region began under RUSSIA’s Peter the Great in the late 16th century. Thanks to the investments of factory owners like the Demidovs and the Striganovs, the Urals became one of the world’s largest producers of metal. By the 1860s, Ural metallurgy had fallen behind new international metallurgical advances. Whereas, at that time, English factory owners used coal for metal melting, the Russians used wood as fuel in blast furnaces that made production inefficient.

In the late 19th century, finance minister Sergei Vitte encouraged the industrialization of UKRAINE instead of the Urals. In 1900, Ukraine produced nearly 60 percent more metal than the Urals. With Josef Stalin’s coming to power in the late 1920s, Ural indus-

try experienced a renaissance. The central government invested heavily. The first Five-Year Plan of 1927 scheduled the creation of a big industrial region combining the coal resources of the west Siberian coal deposits with Ural metallurgy. This was the birth of the giant steel combine of Magnitogorsk, the so-called UKK (Ural-Kuznetsk Combine). The main goal of Stalinist industrialization was the creation of a second industrial basis in the heart of the Eurasian hinterland that was not vulnerable to enemy attacks, as was the western Soviet republic of Ukraine.

The industrialization of the Urals in the 1930s suffered from a labor shortage. Therefore, recruitment was based on forced labor and the Urals became part of the Gulag prison system. It has been estimated that the Urals labor camp population comprised 123,547 households (571,355 people). Magnitogorsk laid the foundation for new industries in the Urals, like automobile production and nickel mining. Today, the Urals are recovering from the Asian economic crisis of the 1990s. In 2002, the Urals had foreign trade of \$26.4 billion. After the meeting of Presidents George W. Bush and Vladimir Putin at the July 2001 Genoa Summit, several U.S. companies began investing in Ural manufacturing enterprises.

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## urban heat island

BY 2015, GLOBAL settlement patterns are projected to cross a threshold where, for the first time in human history, the majority of people will be urban dwellers. By 2025, cities are expected to contain approximately 6 billion people—two-thirds of the world's population. This unprecedented expansion of the number, size, and population of urban areas will have a significant impact on urban climates and is expected to exacerbate the phenomenon known as the urban heat island (UHI). The urban heat island is a temperature anomaly where an urban area is characterized as an island of warmer air amidst a rural sea of cooler temperatures.

First recorded nearly 200 years ago when chemist Luke Howard observed temperatures to be warmer in the center of LONDON, England, than in its surrounding countryside, the intensity of the urban heat island has notably increased as cities have grown in size and population.

By dramatically altering the Earth's landscape, urbanization creates distinctive climates characterized by higher air temperatures. Large urban areas are already 6 to 8 degrees F (3.3 to 4.4 degrees C) warmer than their surroundings, and the heat island effect is projected to double in many rapidly growing cities within the next 50 years. Among the numerous causal agents of the urban heat island effect are increased anthropogenic heat from such urban activity as manufacturing, transportation, and lighting; increased emissions of atmospheric pollutants; and the displacement of natural vegetation in favor of urban construction materials with greater heat absorption capacity. By storing large amounts of solar energy during the day and then emitting this stored heat back into the atmosphere throughout the nighttime, urban structures contribute substantially to the urban heat island effect. Consequently, it is during the night that the heat island effect is most pronounced. In fact, the daytime urban-rural temperature difference tends to be relatively insignificant.

In addition to the built environment, meteorological conditions such as cloud cover, wind speed, and precipitation also influence the UHI. The clear skies and weak winds of a stationary high-pressure system are associated with maximum heat island intensity. A typical urban heat island under these conditions of maximum intensity is associated with three distinct characteristics: a cliff, a plateau, and a peak. The cliff is found at the rural-urban border and is highlighted by a steep temperature differential. The plateau represents the region of gradual temperature increase throughout the urban area. The peak is typically found at the urban center and is identified as the point of maximum temperature. Temperature measurements for the UHI may be taken either at or near the Earth's surface. Increased near-surface temperatures that exist beneath roof levels, analogous to plant canopies, are identified as the canopy-layer heat island.

Measured at the microscale, this urban canopy layer (UCL) combines individual elements of the natural and built environments, including trees and houses, to create climatic variation in small geographic units, such as streetscapes. A combination of several similar streetscapes, as well as the elements between them,

forms a local-scale climate that rises above roof level. The eventual merger of individual local-scale climates creates the urban boundary layer for the entire city, which is measured at the mesoscale. At each successive scale, the urban heat island is magnified, as are concerns over its effects. In addition to numerous hydrological and ecological impacts, the UHI effect can reduce human comfort levels and increase heat-related sicknesses. While the heat island may be viewed as beneficial by reducing the need for heating in cold climate cities, in most places these savings are outweighed by the need for summertime cooling. Not only does air conditioning have higher energy requirements, but the act of running the air conditioner emits heat into air already warmed by the heat island effect.

The design and construction of the built environment have increased the temperature of the urban climate. Ameliorative strategies are now required to alleviate the urban heat island effect. While no city has as yet initiated a comprehensive program aimed at mitigating the effect of the heat island, several "cool communities" strategies are being implemented. Tangible steps being advocated include the roofing and paving of urban areas in lighter colors to reduce heat absorption; the cultivation of small gardens at set distances from each other; and the planting of a well-distributed canopy of shade trees on streets and property lots. Urban design strategies aimed at restricting suburban development through the establishment of urban growth boundaries and promoting infill development and high-density construction are also being advanced. All of these remedial steps are intended to improve the thermal efficiency of an urban area and thereby reduce the urban heat island effect.

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## urban planning

URBAN PLANNING IS A dynamic process that involves designing or planning urban spaces or urban communities. It also involves considerations ranging from land use and zoning to environmental concerns, preservation, gentrification, and issues of growth and urban sprawl. Urban planning frequently requires responding to changes in both neighborhoods and overall urban areas, including changes in the age, class and racial composition of the local area, and the changing needs of the local population. It also seeks to provide proactive solutions to potential urban development problems.

The goal of urban planners is to match the needs and concerns of urban residents with a plan for the urban lived environment in which they are located. This area of research and employment can frequently be broken down into several subfields, including environmental and land use planning, transportation planning, and housing and development. Overarching all of these fields are several general questions that researchers and planners alike debate, including: To what extent are urban planning practices and choices shaped or constrained by past planning practices? What role can and should urban planners play in protecting and shaping environmental policies and practices? Can planning play any role in pursuing social justice or equality?

Urban environmental planning takes into account not only the various resources, including human resources (economic, political, and social resources) and environmental resources (sunlight, water, land, and fuel, for example), but the processes that convert such resources into products and services. It then evaluates the effects that such processes produce, seeking to maximize positive effects and minimize negative effects. Such processes may include transportation, migration, population growth, and manufacturing, to name a few. Desirable positive effects include the production of valued products and access to improved services and education, while negative effects tend to center on pollution and associated environmental dangers (garbage, traffic, urban congestion).

An important aspect of urban planning, integral to developing effective policies and desirable designs, is consideration of the scale or scope of the impact of the urban environment and its associated problems. This is particularly true when considering urban environmental planning issues. While certain problems may manifest themselves initially at a very local level (problems

with garbage collection in a particular neighborhood, for example), the potential impact of such problems can be national. Garbage left uncollected in a particular neighborhood may impact citywide recycling or trash disposal efforts. Problems with an urban region's trash disposal system can have an impact on the surrounding environment—water supply, for example—which can impact the entire state and, if left unresolved, may have the potential to impact an even wider region.

### START OF URBAN PLANNING

The beginnings of urban planning in the United States can be seen in the 19th century, with the rise of a progressive intellectual movement comprising of political scientists, economists, and sociologists who believed that there was a need for public intervention in the economy. The City Beautiful movement developed in the late 19th and early 20th centuries, growing out of a general discontent with urban development. Cities were thought of in nostalgic terms, but increasingly people were abandoning urban areas, and the urban neighborhoods were suffering from decay and deterioration.

Tenements were growing, spawning unhealthy living conditions, poor sanitation and general squalor. In contrast to those who sought to provide social remedies to eliminate such living conditions, the City Beautiful movement, led primarily by upper-middle-class white men, emphasized restoring physical beauty to the urban landscape, and advocated planning cities as works of art, with an emphasis on beauty and landscape architecture. The movement leaders believed that restoration of physical beauty would inspire a sense of civic duty and provide a moral compass in the lower-class urban dwellers.

Contemporary debates over urban planning focus in part on issues of urban sprawl and suburban development. Urban sprawl—the spread of urban dwellers into rational, planned suburban developments—is characterized by shopping centers, office parks, residential subdivisions, and public buildings or civic institutions (schools, churches and town halls, for example). It is seen by many as an unprofitable, environmentally destructive pattern of growth. It develops land at a rapid rate and contributes to an ongoing decline of urban centers.

In addition to the environmental costs, urban sprawl contributes to social problems as well, creating a world of stranded citizens: elderly citizens who have lost their driver's licenses and are not able to access

local businesses on foot, commuters who are stranded in long commutes from suburban homes to urban jobs, school-age children who are left dependent on parents for transportation, and low-income urban dwellers who are stranded in economically and physically failing cities.

### MODERN URBAN PLANNING

Contemporary urban planning is characterized by two movements, New Urbanism and Smart Growth, each of which seeks to combat urban sprawl. As David Godschalk notes, the New Urbanism movement is “an urban design movement committed to reestablishing the relationship between the art of building and the making of community, through citizen-based participatory planning and design.” It seeks to create a “coherent and supportive physical framework” within which socially and economically vibrant communities can thrive.

The New Urbanism movement is explicitly fighting urban sprawl, looking to develop instead urban environments that are designed with pedestrian traffic in mind, as well as traditional automobile and public transportation. The movement supports accessible public spaces and architectural designs that reflect the historical and environmental areas within which they are located. The Smart Growth movement is, likewise, a contemporary urban planning movement, characterized by Godschalk as an “umbrella term” that covers a variety of urban planning concerns arising out of statewide growth management initiatives arising during the late 1990s. The overall concern is to develop a livable community focused on the everyday lived environment and avoid patterns of urban sprawl.

In addition to addressing issues of urban sprawl, contemporary urban planners and those who research in the field of urban planning are frequently drawn to addressing how urban planning has affected (and continues to affect) racial and ethnic divisions, and how such divisions in turn shape urban planning and development.

In the United States as well as Europe, cities are frequently geographically divided by race, ethnicity, and class, and such divisions are frequently expressed through spatial patterns of segregation. Influxes of immigrants into such urban environments further divide the urban environment. Urban planning in such an environment can take several forms in an attempt to address such polarization, as Scott A. Bollens notes: a neutral strategy, an equitable strategy, a partisan strategy, and a resolver strategy.



As Bollens details, the neutral urban planning strategy utilizes an ethnically neutral style of intervention, involving technical criteria disassociated with ethnic identity. Any urban problems addressed by the planners are framed as nonpolitical, purely technical matters that are readily solvable through planning strategies. In contrast to the ethnically neutral style of urban planning embraced by the neutral strategy, the partisan urban strategy purposefully endorses one particular ethnic group's values to the exclusion of lesser ethnic or racial groups.

Such a strategy provides "preferential access to the urban policy-making machinery" for those of the selected ethnic group to the exclusion of other ethnic or racial groups, Bollens explains. The third strategy, equity, seeks to use ethnic identity in an effort to balance inequalities between ethnic groups. Under such a strategy, the size or resources of a particular ethnic group are used to determine the services and spending necessary for planning of a particular area.

As Bollens observes, "[a]n equity planner is aware of group-based inequalities and political imbalances in the city (both historic and contemporary) and recognizes the needs for remediation and affirmative action policies based on group identity." Finally, the resolver strategy places emphasis on the causes of racial or ethnic segregation within the urban environment, including, for example, identification of disempowerment of minority groups. Such a model seeks to create urban environments of toleration and coexistence.

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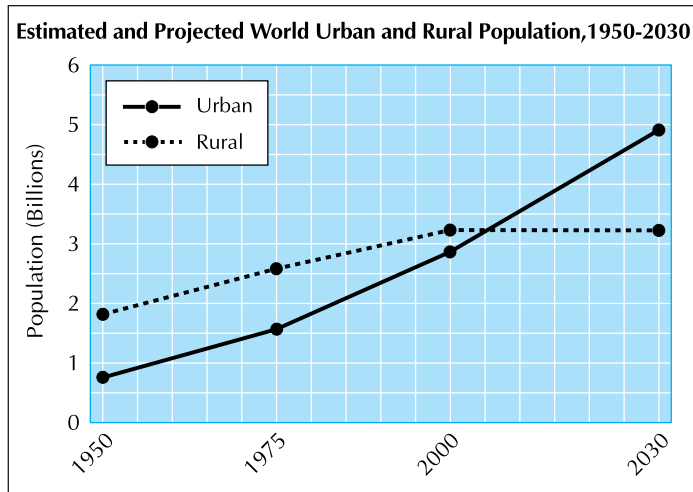
## urbanization

URBANIZATION IS THE process by which large numbers of people become permanently concentrated in relatively small areas, forming cities. The definition of what constitutes a city changes from time to time and place to place, but it is most usual to explain the term as a matter of demographics. The United Nations has recommended that countries regard all places with more than 20,000 inhabitants living close together as urban; but, in fact, nations compile their statistics on the basis of many different standards. For instance, the UNITED STATES uses "urban place" to mean any locality where more than 2,500 people live.

Large permanent assemblies of people have arisen historically in two sharply contrasting ways. Some settlements emerge because a group of people chose to live near each other in order to realize a way life made possible by production activities carried on elsewhere. Other settlements arise because people who work within certain production facilities wish to live in the immediate vicinity of these facilities. In general, then, population may be permanently assembled in order to consume the products and services of labor, regardless of where they are produced, or in order to produce products and services, regardless of where they are consumed.

The words *produce* and *consume* are used in their broadest senses, including not only traditional economic activities, such as commerce and manufacture, but also religious, military, professional, educational, and other similarly organized activities. Examples of consumption-oriented settlements include the modern residential suburbs, the traditional rural village, the ceremonial capital or "court" city, and the urban community of the elite during the social season. Examples of the production-oriented settlements include the manufacturing city, the market town, and the government administrative center, ranging from county seat to national capital.

Whatever the numerical definition, it is clear that the course of human history has been marked by a process of accelerated urbanization. It was not until the Neolithic period, roughly 10,000 years ago, that humans were able to form permanent settlements. Even 5,000 years ago, the only such settlements on the globe were small, semipermanent villages of peasant farmers, towns whose size was limited by the fact that people had to move whenever the soil nearby was exhausted. It was not until the time of classical antiquity that cities of more than 100,000 existed, and even these did not



*With half the world's population now living in cities, projections indicate the urbanization trend will continue into the future.*

become common until the sustained population explosion of the last three centuries. In 1800, less than 3 percent of the world's population was living in cities of 20,000 or more; this increased to about 25 percent by the mid-1960s and to about 40 percent by 1980. It is estimated that now more than half of the world's population lives in urban areas.

The little towns of ancient civilizations, in both the old world and the new, were only possible because of improvements in agriculture and transportation. As farming became more productive, it produced a surplus food. The development of means of transportation, dating from the invention of the wheel in about 3500 B.C.E., made it possible for the surplus from the countryside to feed urban populations, a system that continues to the present day.

Despite the small size of these villages, the people in the early towns lived quite close together. Distances could be no longer than an easy walk, and nobody could live out of the range of the water supply. In addition, because cities were constantly subject to attack, they were quite often walled, and it was difficult to extend barricades over a large area. Archaeological excavations have suggested that the population density in the cities of 2000 B.C.E. may have been as much as 128,000 per square mi (49,400 per square km); today KOLKATA (formerly Calcutta) and SHANGHAI, with densities of more than 70,000 per square mi (112,654 per square km), are regarded as extremes of overcrowding.

With few exceptions, the elite—aristocrats, government officials, clergy, and the wealthy—lived in the center of ancient cities, which was usually located near

the most important temple. Farther out were the poor, who sometimes huddled along the city walls together. However, the situation reversed in the 20th century, when most cities became surrounded by rings of rich suburbs, and only the poor were left in the city centers. In the United States, the suburbs are populated by the affluent and the middle class, who grew up around cities in the 1950s and 1960s, abandoning inner cities.

The greatest city of antiquity was Rome, which at its zenith in the 3rd century covered almost 4 square mi (10 square km) and had at least 800,000 inhabitants. To support this enormous population, the empire constructed a system of aqueducts that channeled drinking water from hills as far away as 44 mi (70 km). Inside the city itself, the water was pumped to individual homes through a remarkable network of conduits and lead pipes, the equal of which was not seen until the 20th century. As in most early cities, Roman housing was initially built on dried clay molded by wooden frameworks. As the city grew, it began to include structures made from mud, brick concrete, and eventually finely carved marble.

This general model of city structure continued until the advent of the INDUSTRIAL REVOLUTION, although medieval towns were rarely as large as Rome. Over the course of time, commerce became an increasingly important part of city life and drew people from the countryside. With the invention of the mechanical clock, windmill, water mill, and the printing press, the interconnection of city inhabitants continued apace. Cities became places where all classes and type of humanity mingled, creating heterogeneity that became one of the most celebrated features of urban life.

The technological explosion that was the Industrial Revolution led to a momentous increase in the process of urbanization. Larger populations in small areas meant that the new factories could draw on a big pool of workers in Europe, many of them living in miserable conditions attracted by a promise of paid work. Migrants from the rural areas flooded into the city, only to find it awash in refuse, disease, and rodents. Designed for commerce, the streets of the newer cities were often arranged in grid patterns that took little account of human needs, such as privacy and recreation, but allowed these cities to expand indefinitely. Although highly urbanized areas are generally highly industrialized areas, urbanization is not a simple function of industrialization.

It is speculated that one result of the continuing population explosion will be the creation of megalopolises, concentrations of urban centers that may ex-

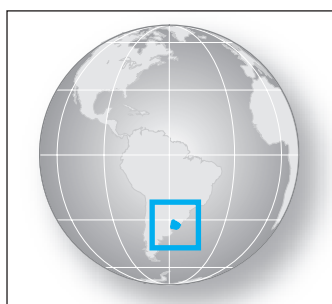
tend scores of miles. It is thought that the first such growth could occur on the East Coast of the United States, where there may eventually be a single urban agglomeration stretching from Boston to Washington, D.C. Other emerging megalopolises include the Tokyo-Osaka-Kyoto complex in JAPAN, the region between LONDON and the Midland cities in Great Britain, and the NETHERLANDS-central BELGIUM area.

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## Uruguay

**Map Page** 1141 **Area** 68,039 square mi (176,220 square km) **Population** 3,413,329 **Capital** Montevideo **Highest Point** 1,686 ft (514 m) **Lowest Point** 0 m **GDP per capita** \$12,800 **Primary Natural Resources** rice, wheat, corn, barley, livestock, fish.



THE ORIENTAL REPUBLIC of Uruguay, more simply known as Uruguay, is a South American country with a population of about 3.4 million people and situated along the ATLANTIC OCEAN between ARGENTINA and BRAZIL. The capital, Montevideo, is the seat of the three-branch federal government, consisting of a strong executive whose power is constrained by checks from the legislative and judicial branches. Governmental administration separates Uruguay into 19 different departments, which communicate with the federal gov-

ernment through a subordinate governor. Even though Uruguay's constitution has been in existence since 1967, the military took control of the government for most of the 1970s and early 1980s. The year 1989 marked the country's first free elections since the restoration of civilian government.

Following an international policy founded upon nonintervention, dialogue, and regional development, Uruguay has succeeded in establishing one of the most stable and free societies in South America. Uruguay's economy suffered a major downturn starting in 1999 and lasting until 2002, threatening the country's status and stability as unemployment skyrocketed to almost 20 percent. Lower demand for goods in Argentina and Brazil sparked the downturn, but fears were calmed when Uruguay was able to sign a debt restructuring agreement with the International Monetary Fund and the UNITED STATES.

### ROLLING PLAINS

The lands of Uruguay cover an area slightly smaller than the state of WASHINGTON. The lands are sometimes referred to as a geographic transition between the relatively featureless Argentine plains on one border to the hilly lands of southern Brazil. Consequently, the majority of Uruguay's territory is classified geographically as rolling plains. Flat plains are found along the country's eastern, southern, and western borders, while the interior consists of rolling plains and hills. The Atlantic coast is marshy and sandy with a number of shallow lagoon inlets, whereas the coasts of the Rio de la Plata and the Rio Uruguay are less wet and broader.

Uruguay's most valuable resource is water, since prominent bodies of water form the country's eastern, southern, and western borders. There are a number of sizable lakes situated in the interior of the country, which also has a high water table allowing for the digging of wells and the establishment of irrigation where necessary. Three major river systems are found within Uruguay's territory, which drain into the Rio Uruguay and the Atlantic Ocean. The most important river is the Rio Negro, which crosses the country from northeast to west, draining into the Rio Uruguay. It is dammed, creating the largest reservoir in South America, known as the Embalse del Rio Negro.

Thanks to the country's rolling plains and lack of mountains, Uruguay's entire climate is temperate and fairly uniform nationwide. In addition, the lack of mountains makes the lands vulnerable to high winds and quick changes in weather. Seasons differ, as spring is damp and cool; summers are warm but cooled by

ocean winds; autumns are relatively mild; and winters are cold and often extremely damp.

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## U.S. Minor Outlying Islands

EIGHT TINY SPECKS of land dotting the PACIFIC OCEAN are the marks of the U.S. military presence in the region during the two major conflicts of the 20th century. The names Wake and Midway are forever linked to major air and land battles of World War II. The others are little known and are mostly maintained now as nature preserves and scientific outposts. Only Johnston Atoll had a population of any size, as the location of a chemical disposal facility, and this is in the process of closing. The U.S. Fish and Wildlife Service now administers these former outposts of U.S. military might in the Pacific.

Most of these islands are located due north of KIRIBATI and east of the MARSHALL ISLANDS. Wake is to the north of the Marshalls, and the Midway Islands are at the westernmost extremity of the Hawaiian Island chain, just about midway from CALIFORNIA to JAPAN. Palmyra and Kingman Reef are at the northern end of the Line Islands, which now belong to Kiribati. Johnston Atoll is a much further extension of this same chain but stands on its own about halfway to Hawaii.

They are all low-lying coralline islands with fringing reefs. They range in climate from subtropical (Midway), to tropical (Jarvis, Johnston, and Wake), to equatorial (Baker, Howland, and Palmyra). Baker, Howland, and Jarvis are all very dry and suffer from strong winds and burning sun. Johnston is also dry. Palmyra, however, is very rainy because of the equatorial countercurrent and has much denser vegetation on its two main islands, with coconut trees and balsa-like trees up to 100 ft (30 m) tall. Nearby Kingman Reef has no permanent land, and Midway and Palmyra are mostly very flat with surrounding reefs. Wake is an atoll of three coral islands on an underwater volcano.

In the 19th century, Americans began to take interest in some of the islands of the Pacific for their de-

posits of guano (seabird dung), which was mined for use in fertilizers and fuels. The U.S. Guano Islands Act of 1856 established claims over a number of isolated islands, including Baker, Howland, Jarvis, and Johnston (and some of the islands now belonging to Kiribati, notably Canton and CHRISTMAS islands). Palmyra was claimed in 1862 by the Kingdom of Hawaii, and passed to the UNITED STATES with Hawaii's in 1898.

The United States annexed Midway in 1867, and Wake Island followed in 1899 for the purposes of laying the Trans-Pacific Cable, which was also laid through Midway. Guano mining ceased in the last decades of the 19th century, and most of these islands were transformed into refueling stops for journeys across the Pacific, first for ships, and then for airplanes in the 1930s. The most recent addition, Kingman Reef, was annexed in 1922 as a way station for flying boats from Hawaii to Samoa.

There were short-lived attempts to colonize Howland, Baker and Jarvis in 1935, but these islands were evacuated during World War II and never reestablished (though there is an amazingly convincing website for the fictional "Republic of Howland Baker and Jarvis" on the internet). The 20th century's most famous aviatrix, Amelia Earhart, was headed toward the refueling stations on Howland during her round-the-world flight of 1937. Her craft disappeared, however, and a beacon remains on the island to commemorate her.

Midway and Wake remained important stopover points for transpacific flights until larger airplanes made this unnecessary in the 1970s. Palmyra and Johnston (along with Christmas and Canton) became important air transport stations in World War II (Wake was occupied by the Japanese in 1941). The Battle of Midway in 1942 was a turning point of the war in the Pacific, but after the war, most military presence on these islands was shut down except for Wake, Midway, and Johnston. The last was used for high-altitude nuclear tests in the 1950s and 1960s, then converted into a storage and disposal site for chemical weapons: JACADS (Johnston Atoll Chemical Agent Disposal System), at its height of activity maintained a population of about 1,100 military and civilian personnel.

Since the 1990s, most of these islands have been transferred from the jurisdiction of the Department of Defense to the Department of the Interior's Fish and Wildlife Service. Naval operations on Midway were closed in 1993, followed by the U.S. air base on Wake (though some military contractors remain) and the gradual shutdown of the facilities on Johnston in 2000 (where about 800 people remained in early 2003).



Baker, Howland, and Jarvis are a National Wildlife Refuge, home to seabirds and marine wildlife, and visited by scientists and educators. Johnston and Midway are also National Wildlife Refuges but remain mostly closed to the public—Midway is particularly attractive to tourists for wildlife observation and photography, sport fishing, snorkeling, and scuba diving (mostly from HAWAII), and it is hoped the area will reopen to the public soon. Palmyra has been privately owned by The Nature Conservancy since 2000 (purchased for \$37 million to save it from becoming a nuclear waste dumpsite).

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## Utah

THE BEEHIVE STATE, covering an area of 84,990 square mi (220,124 square km), is located in the southwest United States and features a dry, mountainous topography. Utah is rectangular in shape, except for a small corner cut away in the northeastern portion of the state. The state is bounded to the north by IDAHO and WYOMING, to the east by COLORADO, to the south by ARIZONA, and to the west by NEVADA. At the southeastern corner of Utah is the junction that is known as “the Four Corners,” the point where Utah, Arizona, NEW MEXICO and Colorado meet. The lowest point in the state is more than 2,000 ft (610 m) above sea level and the highest point is Kings Peak at 13,528 ft (4,123 m). The presence of subranges of the ROCKY MOUNTAINS means there are peaks over 9,842 ft (3,000 m) in height.

The unique geology of Utah can be seen in its many national parks and monuments, including Canyonlands National Park, Zion National Park, and Bryce Canyon National Park. Colorful and dramatic natural features such as canyons, sandstone outcrops, stone arches and bridges, rock spires, cliffs, gorges, and mountains can be seen in locations across the state. The major rivers in Utah are the Colorado River and



*An 1896 photo of the Mormon temple and tabernacle shows the definitive presence the settlers created in Salt Lake City.*

the Green River, both in the eastern half of the state. Much of Utah is either arid or semiarid, with many areas receiving less than 10 in (25 cm) of rain annually. The Great Salt Lake is one of the unique features of the state. At about 4,200 ft (1,280 m) in elevation, the lake is several times saltier than the oceans of the Earth. The lake varies in size, but the average is about 1,700 square mi (4,403 square km). Because of the extreme saltiness, there are no fish in the water, and recreation is limited to sailing because of the corrosive nature of the concentrated salt. The Great Salt Lake Desert is in the northwest portion of the state and is part of the Great Basin Desert that covers several states.

Major cities include the capital, Salt Lake City, as well as Provo and Ogden. Summers are hot and winters are cold. Tourists go to Utah to see the natural splendors and for outdoor activities such as hiking and skiing. The 2002 Winter Olympics were held in Salt Lake City, Utah. They are also drawn to the capital city to see, among other sights, the giant Mormon Temple.

The first European explorers to venture into what is now Utah were a party led by two Spanish priests. Their six-month-long mission began in July 1776 but did not lead to any permanent settlements. The Latter-day Saints, also known as the Mormons, were the first settlers in the 1840s. Their leader, Brigham Young, was seeking a place to settle where the Mormons could be left alone after the founder of the Mormon faith (Joseph Smith) had been murdered back east. Young reached the site of Salt Lake City and declared that was the spot where the Mormons should settle.

In 1865, the Black Hawk War broke out with the local Native American tribes, including the Utes and Paiutes. Intense hostilities between the Mormons and the natives continued until 1867, and then intermittently until 1872, when federal troops finally arrived. An important milestone in history occurred in 1869, when Utah was the scene where the golden spike was placed upon the completion of the transcontinental railroad at Promontory Point. The discovery of silver and gold in Utah helped spur growth. Utah became the 45th state to join the Union when it was admitted in 1896. The construction of two key dams in the late 1950s helped add to the water supply and encourage tourism. The Mormon presence in Utah has remained strong over the years, and about 70 percent of the population is still Mormon.

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## Uzbekistan

**Map Page** 1119 **Area** 172,742 square mi (447,400 square km) **Population** 26,410,416 **Capital** Tashkent **Highest Point** 14,111 ft (4,301 m) **Lowest Point** -39ft (-12 m) **GDP per capita** \$1,700 **Primary Natural Resources** natural gas, petroleum, coal.



THE REPUBLIC OF Uzbekistan, the most populous Central Asian republic of the former Soviet Union, is one of the world's only countries that is LANDLOCKED and bordered entirely by other landlocked states (LIECHTENSTEIN is the other). Achieving its independence in 1991 following the Soviet Union's collapse, Uzbekistan has the potential to become the region's most prosperous country. It is located at the heart of

Central Asia, and bordering countries include KAZAKHSTAN to the north and west, TURKMENISTAN to the southwest and south, AFGHANISTAN to the southeast, and TAJIKISTAN and KYRGYZSTAN to the east. Uzbekistan is steeped in history, being home to the ancient SILK ROAD centers of Bukara, Kiva, and SAMARQAND. For its part, Samarqand is home to the famed Registan, considered the "Taj Mahal" of Central Asia. The shrinking ARAL SEA, extending into Uzbekistan's northwest Karakal-pakistan province, represents one of the worst ecological disasters in world history.

The physical landscape of Uzbekistan is primarily made up of deserts. The lone exception is the country's easternmost areas, which contain semi-arid STEPPE grasslands. The river valleys of the Syr Darya, AMU DARYA, and Zarafshon are intensively irrigated for farming. Major lakes in Uzbekistan include the aforementioned Aral Sea and Aidarkul Lake, located just southwest of TASHKENT.

The heavily populated Ferghana valley to the east is surrounded by the mountains of Kyrgyzstan and Tajikistan. Uzbekistan's most important natural resources are its natural gas, petroleum, and gold deposits. The importance of gold to Uzbekistan's economy is demonstrated by the Muruntau Gold Mine, which during the mid-1990s was the largest gold mine in the world. Areas of Uzbekistan are seismically active, and much of the capital city of Tashkent was destroyed by a 1966 earthquake.

The distribution of Uzbekistan's population is mainly concentrated in the Ferghana valley, centered on the cities of Tashkent (population: 2,295,300), Namangan (442,300), and Andijon (362,600). Uzbekistan's third-largest city, Samarqand (419,600), is located well to the southwest of the Ferghana valley. The population's ethnic composition includes Uzbek (80 percent), Russian (5.5 percent), Tajik (5 percent), Kazakh (3 percent), Karakalpak (2.5 percent), and Tatar (1.5 percent) peoples. The primary language spoken in Uzbekistan is Uzbek (spoken by 74 percent of the population), and significant numbers of citizens speak Russian (14 percent) and Tajik (4 percent).

Like the other countries of Central Asia, the dominant religion in Uzbekistan is ISLAM (88 percent of the population), with sizable numbers adhering to Eastern Orthodox (9 percent). Given its endowment of human and natural resources, Uzbekistan has the potential to become Central Asia's most prosperous economy. Currently, however, agriculture remains the dominant sector, employing 44 percent of the labor force. Cotton, or "white gold," remains the most important agricultural

crop. Uzbekistan is the world's second-largest exporter of cotton. Other agricultural products include vegetables, fruits, grain, and livestock. Industrial production, employing 20 percent of Uzbekistan's labor force, is limited to natural gas, oil, gold, chemicals, and agricultural machinery.

Perhaps the most pressing geographical/political issue facing Uzbekistan is its complex eastern boundary with Kyrgyzstan and Tajikistan. Boundary delimitation is not settled with either of these countries. In addition, this complex boundary structure has relegated sizable Uzbek populations to reside outside of Uzbekistan. Nearly 25 percent of Tajikistan's population are ethnic Uzbeks, while in Kyrgyzstan Uzbeks comprise 14 percent of the population. The major eco-

logical challenge facing Uzbekistan is the disappearing Aral Sea and the associated pollution, infant mortality, cancer, and tuberculosis. Average life expectancy in Uzbekistan as a whole is just over 64 years, although in the Karakalpakistan villages surrounding the Aral Sea, this figure is as low as 38 years.

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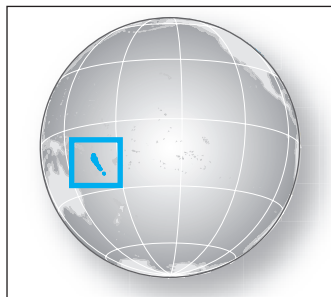






## Vanuatu

**Map Page** 1128 **Area** 4,758 square mi (12,200 square km) **Capital** Port-Vila **Population** 199,414 **Highest Point** 6,194 ft (1,877 m) **Lowest Point** 0 m **GDP per capita** \$2,900 **Primary Natural Resources** manganese, hardwood forests, fish.



UPON ACHIEVING independence from FRANCE and Great Britain in 1980, the peoples of the islands known as the New Hebrides renamed the island nation Vanuatu—"forever our land"—in a strident attempt to break with one of the most turbulent colonial histories of the developing world. The Y-shaped chain of four main islands and 80 smaller islands, 1,240 mi (2,000 km) northeast of AUSTRALIA, has contended with violent competition between French and British colonial authorities, determinedly zealous Christian missionaries, and unscrupulous planters and pirates, not to mention the violence of its own indigenous intertribal conflicts and the natural dangers of life on some of the most active volcanic islands on the planet.

On the border between the South PACIFIC and the Coral Sea, the islands of Vanuatu were formed from

volcanic activity along the colliding Pacific and Indo-Australian continental plates. Geological activity contributes frequent EARTHQUAKES, TSUNAMIS, and volcanic eruptions—more than six volcanoes are currently active—which in places has been turned to economic advantage: Mount Yasur, on the island of Tanna, is one of the most accessible erupting volcanoes in the world, and visits (primarily at night) are an important part of most tourist itineraries. The land is mostly mountainous, with low coastal plains. Espíritu Santo and Malakula are the largest islands, with nearly half of the total land area, though the capital, Port Vila, and much of the population are on Éfaté. The other large town is Luganville on Espíritu Santo. Some of the smaller islands are coral and limestone, rather than volcanic, but only one is purely a coral atoll.

Sir Francis Drake named the islands New Hebrides, after the islands off the coast of Scotland, when he passed through in the early 17th century. Lying between two competing colonial zones in MELANESIA, the islands were approached by rival European traders and missionaries: British from the SOLOMON ISLANDS to the north, and French from NEW CALEDONIA to the south. First attracted to the large amounts of tropical hardwood (notably sandalwood), Europeans soon shifted their interests to the population themselves, shipping them off in great numbers to work plantations in Australia, FIJI, New Caledonia and the Samoas, leaving

much of the islands under-populated. Both British and French settlers established plantations and conflicts between these groups led to the establishment of an Anglo-French condominium administration in 1906. Unique in the world of colonial administrations (it has been called an “elaborate joke”), the shared government resulted in virtually no government at all.

Three separate administrations—one for the French residents, one for the British residents, and one for the Melanesians, who also continued to maintain their traditional tribal governments—meant that there was very little concerted effort at developing of roads or government, and the islands were largely unprepared for independence when it finally came in 1980. Most of the population relies on subsistence or small-scale agriculture.

Most of the French population was not eager for independence, since much of the land faced confiscation by a Melanesian-run government, and pro-French militant groups had to be put down with assistance from Australia and PAPUA NEW GUINEA. France itself is wary of influence on neighboring New Caledonia, which continues to struggle for independence, and also contends with Vanuatu over possession of Matthew and Hunter islands, far to the south.

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## Vatican City

**Map Page** 1131 **Area** .273 square mi (.44 square km)  
**Population** 911 (2003) **Highest Point** Vatican Gardens 252.6 ft (77 m) **Lowest Point** Saint Peter’s Square 62.4 ft (19 m) **GDP per capita** not available **Primary Natural Resources** none.



THE STATE OF VATICAN City is the world’s smallest independent state. This tiny city situated on a hill in Rome, ITALY, is the capital of the Roman Catholic Church and holds the residence of the pope. Only around 900 people live in Vatican City, but millions of Roman Catholics from all over the world travel each year to visit St. Peter’s Basilica and gaze at the artistic treasures.

The Holy See refers to the central government of the Roman Catholic Church. It is the supreme authority of the church, and places the pope as the bishop of Rome and leader of the College of Bishops. The Holy See has characteristics of a state in the rule of international law, and members can sign treaties, receive international diplomats, and be part of international organizations. The Vatican City state and the Holy See are united through the pope as head of state. The pope holds full judicial, legislative, and executive powers in Vatican City.

The history of Vatican City can be traced to Roman times where, originally, summer villas were constructed on Vatican Hill. Caligula built his private circus in the area, and in 65 C.E., the Romans reportedly sacrificed Christians in the Circo Vaticano. Saint Peter, the Roman Catholic Church’s first pope, was killed on this spot by the Romans. Around 100 years after his death, a monument was built for Saint Peter, and between 324 and 326, Emperor Constantine ordered a basilica to be built above Saint Peter’s tomb.

The original basilica stood for over 1,000 years. However, as the decades passed, the building fell into disrepair. The old basilica was ultimately destroyed along with the beautiful art inside the church. For 150 years, the new basilica was constructed with the aid of some of the world’s most recognized artists. Giacomo della Porta, Bramante, Raphael, and Michelangelo were among the many. Michelangelo, at the age of 72, designed the 390 ft (119 m) dome, which can hold up to 60,000 people in the interior.

From the 8th century through the 19th century, the Roman Catholic popes controlled the papal states, a territory that expanded across central Italy. In 1860, Victor Emmanuel’s army gained control of these states, which left only Rome and the surrounding coastal sections under the pope’s control. During the 1870s, Napoleon III occupied Italy but was eventually forced out by Emmanuel’s army. Emmanuel declared Rome the capital of Italy. However, Pope Pius IX refused to recognize the kingdom of Italy, and for over 50 years, the Vatican disputed the legitimacy of rule throughout Italy. During this period, Vatican City did not officially

exist, but members of the Holy See maintained diplomatic relations.

In the 1920s, the Italian dictator Benito Mussolini worked with the papal authorities in the creation of an independent papal state. In 1929, the Lateran Treaty was signed which recognized the sovereignty of the Holy See and the establishment of the state of Vatican City. The relations between the Italian government and the papal state were defined through a concordat, and financial compensation was granted for the losses in 1870. In 1984, a revised concordat was signed, which declared Roman Catholicism as the primary religion in Italy.

In 1954, Vatican City was placed under the protection of the La Haye Convention. Through this act, all of the state's cultural goods are safeguarded in case of a military conflict. Overall, the Vatican's treasures are considered possessions of humanity and portray the rich history of the Roman Catholic Church and Vatican City that spans for almost 2,000 years.

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## vegetation geography

GEOGRAPHERS ARE CONCERNED with studying elements of the natural and human environments. They want to determine the relationships between these elements and wish to explain their patterns of location. Vegetation is an important and highly visible element of the natural and cultural environment. To the trained eye, vegetation offers a rapid means of determining habitat suitability for various human endeavors.

One way that geographers study vegetation is to investigate environmental relationships. Vegetation has significant relationships with climate and water, soils, landforms, other plants, animals, and humans. Vegetation has such a close relationship with climate that geographers often proclaim that vegetation is the mirror of climate. Comparing a world vegetation map with a world climate map in any good atlas clearly shows that specific categories of vegetation are associated with

certain types of climate. To illustrate, we always find desert vegetation in areas with arid climate, savanna vegetation is usually associated with tropical wet and dry climate, steppe vegetation is most often located in areas with semiarid climate, and the northern coniferous forest is part of subarctic climate regions.

Vegetation responds to temperature and moisture conditions. As a rule, the higher the temperature, the faster the rate of plant growth. Tropical rainforest trees may grow to maturity in as little as 25 years, while those in the northern coniferous forest may need 75 years or more. Plant metabolism slows greatly and significant tree growth stops when temperatures drop below 50 degrees F (10 degrees C). Many tropical plants cannot survive temperatures below freezing. Most plants depend upon seasonal rainfall, although some can draw upon groundwater supplies. In mid-latitude regions, trees require a minimum of about 20 in (50 cm) of rainfall per year. Some tree species require wetlands while others are adapted to life in drier terrain. The cypress tree, for example, is hygrophytic (water-loving) and grows in swampy parts of the southeastern United States. Oak, maple, and ash trees, however, prefer drier conditions.

Plants grow in soil. Soils must contain the nutrients and moisture conditions that plants need in order to survive. Unlike cultivated plants, which are "soil robbers" that demand many nutrients from the soil, natural vegetation is less demanding. Nevertheless, soil conditions affect vegetation patterns. Here is an example: we would not normally expect to find large numbers of coniferous trees in the mid-latitude mixed forest of the southeastern UNITED STATES. However, this part of the country contains regions with poor quality sandy soils; coniferous trees predominate in these regions because they tolerate such soil conditions better than broadleaf deciduous trees.

Plants in turn affect soils. Some plants, such as clover, have nodules on their roots containing bacteria that manufacture nitrates, an essential soil nutrient. After death, plants contribute organic matter to the soil. Midlatitude grasses contribute the most organic matter, while trees supply moderate quantities. Temperatures affect the rate at which organic matter decays; moderate temperatures maximize the soil's humus, which is partially decayed organic matter. The best soils are rich in humus. The best soils are also found where rainfall levels are not so high that they wash nutrients and minerals out of the soil.

Landforms affect plant life in several ways. The higher the altitude, the lower the temperature; there-

fore, the types of plants one encounters near the top of a mountain differ from those at the base. Mountain ranges influence precipitation distribution patterns; lush vegetation is often the rule on the rainy windward side of mountains, while the lee side, in the rain shadow of the mountains, is more arid and home to plants that exhibit dryland characteristics.

Animals have an interrelationship with plants, too. Who hasn't heard about the beneficial effects of earthworms? Birds eat and spread seeds; so do fruit-eating animals. Herbivorous animals eat plants; overgrazing can have hurt plant life. Humans, of course, cultivate plants that they have domesticated. They modify the natural environment and plow the soil to do this, killing or removing weeds that compete with their crops. Although people believe that trees contribute beauty to the natural landscape, they also consider trees to be either obstacles or resources. Farmers in colonial New England removed trees to provide more land for crop cultivation. Other colonists cut down trees to build houses and ships and to make containers for carrying cargo. Native Americans, on the other hand, looked at the forest as habitat for the animals they wanted to hunt. The ways that different groups of people view trees and other kinds of vegetation depends on their cultural perspective.

Another approach that geographers take to the study of vegetation is to classify plant types in order to understand complicated patterns.

For example, most plants are either broadleaf or needle-leaf. Broadleaf plants, in turn, are either deciduous or evergreen. Deciduous broadleaf plants are found mostly in the mid-latitudes, where cold temperatures during the winter cause plants to shed their leaves and enter a period of dormancy. Examples of this category of plants include hardwoods such as maple and oak trees. Broadleaf trees found in the tropics are mostly evergreen, except when plants shed their leaves in response to seasonal drought. Examples of these include mahogany and greenheart trees. Needle-leaf trees are also known as coniferous trees because most of them produce cones as a way to reproduce. Needle-leaf trees are predominantly evergreen. The tamarack is an exception, since it sheds its needles during winter. Pine, cedar, spruce and fir are all examples of evergreen needleleaf trees. Mostly softwoods, they are found in a wide range of latitudes where they tolerate poor soils and cold temperatures well.

Another way that geographers classify vegetation is to look at biomes or plant associations. We have identified four major biomes: forests, tropical grasslands,

mid-latitude grasslands, and deserts. Rather than focus upon individual plant types in these biomes, as botanists do, geographers find it more useful to study plant associations, that is, the combination of plants found in any place.

## PLANT ASSOCIATIONS

Forests are plant associations that are dominated by trees. Forests are found wherever average annual temperatures exceed 50 degrees F (10 degrees C) and annual rainfall is higher than 18 or 20 in (46 or 50 cm). Trees cover approximately one-quarter of the Earth's land surface. One thousand years ago, about half of the Earth's land surface was tree-covered. This means that we have cut down about half of the earth's forests during the past ten centuries.

The mid-latitude mixed forest is one type. It covers much of eastern North America and western Europe, among other places. It takes its name from the mixture of broadleaf deciduous and evergreen needle-leaf trees found within it. Humans cut down these trees for lumber and to clear space for farming and cities.

The northern coniferous or boreal forest is found only in the Northern Hemisphere. The largest area of this type of forest stretches across Eurasia from Scandinavia in the west to the northeastern corner of RUSSIA. For that reason, we often use the Russian word *TAIGA* to identify it. The coniferous forest that extends from ALASKA eastward across CANADA is almost as large. The trees in this type of forest are mostly needle-leaf, but islands or enclaves of broadleaf trees such as birch, poplar and aspen can be found within the sea of coniferous trees, most of which are softwoods. Industries use the coniferous trees for lumber or may grind them up to create wood pulp for papermaking. Because of their high pitch content, they burn easily, and forest fires are a problem in this part of the world. Average temperatures in Canada and Russia are low, so trees grow slowly. It may take as long as 75 years for trees there to grow to maturity, so conservation (wise use) of this resource is important.

Unlike the taiga, tropical RAINFOREST trees are primarily dense hardwoods. They have buttress roots and rise straight up branching out 100 feet or so above the ground to form a leafy canopy. Here is where many arboreal (tree-dwelling) animals live, far above the forest floor. Parasitic plants such as lianas (vines) attach themselves to the trees, sucking nourishment from the host plants. Epiphytic (air breathing) plants also attach themselves to tree trunks and branches. Epiphytes take their nourishment directly from the air, however; or-



chids are a good example. The canopy prevents much light from reaching the forest floor, which has limited undergrowth because of low light levels. Wherever sunlight does manage to penetrate the canopy, as along the banks of streams or where trees are widely spaced, a tangled profusion of undergrowth called jungle is the result. One might logically conclude that the soils supporting such vegetation would be rich and fertile, but this is not the case. They are poor in quality and low in nutrients, the result of intense weathering in hot temperatures and extensive leaching by heavy rains. The trees remove few nutrients from these soils, though, unlike most of the crops that farmers grow.

## DEFORESTATION

Humans are cutting down rainforests at a rapid pace; this activity is known as deforestation. Tropical forests have already almost entirely disappeared from the island of MADAGASCAR and the country of HAITI. The world's largest rainforest, in the AMAZON Basin of South America, is shrinking fast. If the current rate of destruction continues, geographers predict that it will disappear well before the end of the 21st century. Rainforests in Africa and Southeast Asia are also endangered.

Several variants of tropical rainforest exist. Tropical semi-deciduous forests are found on the margins of tropical rainforests, in places where a short dry season occurs. At this time of year, trees shed many of their leaves. Mangrove forests occur along seacoasts wherever tropical rainforests can be found. Botanists have identified several kinds of mangrove trees; all grow in salt water and have complex root systems that provide a home to many marine creatures. (See the article on GALLERY FORESTS for more information about that type of vegetation).

Mediterranean scrub forest is found in areas with Mediterranean climate. This is the only climate in which most precipitation falls during the coldest months. Owing to low rainfall (normally less than 30 in or 75 cm a year), trees are widely scattered here. Bushy vegetation called maquis fills in the empty spaces between trees. Mediterranean region inhabitants have discovered that this environment is ideal for growing olive and citrus fruit trees; vineyards full of grapes are common, too. In some places within these regions, we find very large trees such as the California redwood. They seem out of place and are relics of a time long ago when the climate here was rainier.

Tropical GRASSLANDS, or savannas, are associated with the alternating precipitation regime of tropical

wet and dry climates. Most savannas are found adjacent to and pole ward from tropical rainforests. Here, savannas experience six months of rain and six months of drought every year, a feast or famine situation. Floods are common during the rainy season; the landscape turns brown and parched during the dry season. Some trees may grow here in wet spots, but tall grass predominates. It can be so tall that you must be on an elephant to see over it, hence the name "elephant grass." Such grass can be sharp-edged and saw-toothed. Humans find it difficult to use savannas for much more than beef cattle ranching; the climate and poor soil quality make farming a challenge.

Mid-latitude grasslands come in several varieties. They are transitional between rainy forested regions and arid desert terrains. On the rainy end of the spectrum, we find prairie grasslands. Their tall grass can reach up thigh high; bushes and wildflowers are commonly intermixed with the grass. The grass forms a thick turf; underneath we find dark brown rich soils, among the best anywhere in the world. Very little prairie grassland remains in the world today, because most has been plowed up for crop agriculture. STEPPE grasslands are found at the dry end of the continuum. The grass in these areas is usually shin high. It is generally too dry here for crop cultivation without irrigation. Soils may also be too salty for farming. Thus, people living in these areas usually choose to raise livestock such as beef cattle or sheep. Unfortunately, overgrazing may lead to accelerated soil erosion and to the invasion of undesirable plants from nearby deserts.

## DESERTS

Deserts cover a larger land area than any other category of vegetation but are widely misunderstood by persons who live in rainy landscapes. They conceive of deserts as absolutely barren sandy wastelands, devoid of any life. It is true that shifting seas of sand, called ERGS, do cover parts of some deserts, but they are more the exception than the rule. In other places, we encounter bare ground topped by scattered moving sand dunes such as the crescent-shaped dunes of Peru's Atacama Desert. In still other places, winds have blown away dust and sand, leaving behind regs, which are pebble- and rock-covered surfaces. Dust and sand storms are frequent problems in these windy environments.

Most deserts, are characterized by bushy vegetation that is called chaparral in Spanish-speaking countries. Desert plants have evolved a variety of water conservation features. Cactus plants store water in

their fibrous tissue. Many plants have waxy leaves that cut down on water loss through transpiration. An example of this is the cresote bush, to which the parasitic mistletoe plant frequently attaches itself. The ocotillo bush exudes poison from its roots to prevent the growth of other plants nearby during times of water scarcity. All of these evolved features are called xerophytic adaptations. A variety of animals lives in and around these bushes. The annual rainfall in deserts is typically less than 12 in (30 cm) and undependable. When it does rain, however, it often comes in the form of cloudbursts, followed by flash floods in desert canyons.

Deserts expand and contract with changes in annual rainfall. Sometimes human activities such as firewood collection or overgrazing can cause deserts to enlarge. The process of desert expansion is known as DESERTIFICATION.

The world's largest desert is the SAHARA of North Africa. *Sahara* is an Arabic word that means "desert." Other important deserts include the KALAHARI and Namib of southern Africa, the Arabian of Southwest Asia, the GOBI in China, the Great Australian Desert, the Mojave desert in the southwestern part of North America and the Atacama Desert of CHILE and PERU.

To these four major plant associations we must add some minor plant associations. First is TUNDRA vegetation. This is found mostly in the Northern Hemisphere in places where temperatures are too cold to permit tree growth, especially along the Arctic coastline of Canada, Alaska, Russia, and Scandinavia. The predominant kinds of vegetation are consequently bushes and grasses, plus mosses, lichens, and sedges. Since water is frozen for much of the year in the tundra, it is unavailable for plants to use, and they experience physiological drought. The surface layer of the soil melts during the warm season. A permanently frozen layer beneath the surface, known as permafrost, prevents this meltwater from seeping down through the soil. Ponds and swamps are therefore common on the tundra surface during the summer. They provide a perfect breeding place for mosquitoes and other insects. Mosquitoes plague visitors to the tundra during summer.

Another minor plant association is mountain vegetation. As its name implies, it is found in the world's biggest mountainous regions, such as the ANDES MOUNTAINS of South America. A German geographer, who used Mount Orizaba in MEXICO as his model, was first to describe this vegetation category. We therefore use the Spanish terms he employed in his description. He noted that temperatures decrease with increases in alti-

tude in mountainous regions; therefore the kind of vegetation found at high altitudes is different than that at low altitudes. Vertical zonation of vegetation identifies this phenomenon. The sequence and contents of zones are more important than their altitude limits, which can and do vary according to the latitude of the mountain. Here is how the zones are arranged from high to low, for example, on Mount Orizaba, Mexico: zone of permanent snow and ice: normally avoided by humans; zone of alpine grasses: livestock grazing; forested zone: firewood collection; *tierra fría* (cold land): zone of grains such as wheat; *tierra templada* (temperate land): zone of coffee and corn; *tierra caliente* (hot land): zone of tropical crops such as sugarcane.

Spotty distribution of precipitation is also characteristic of regions with mountain vegetation. The windward sides of mountains are typically well watered, while the lee sides, in the rain shadow of the mountains, may exhibit arid conditions.

Finally, some parts of the Earth are devoid of any vegetation. Most important of these is the continent of ANTARCTICA, which is almost entirely covered by a permanent layer of snow and ice.

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## vegetation zones

THE COMPOSITION OF associations among plant species tends to vary regularly across gradients of altitude, latitude, temperature, soil types, and other vari-

ables. Making use of this observation, biogeographers are able to delineate distinct sets of conditions along such gradients that reflect changes, sometimes abrupt, in the distribution of plant associations. Where two or more such changes occur, the ecology of a region may be divided into distinct vegetation zones.

The concept of the vegetation zone, alternatively called a life zone, is sometimes taken to be synonymous with the concept of the BIOME, and the terms are often used interchangeably in some scientific literature. The designation of biome, however, is more correctly applied at a higher level of generality.

The vegetation zone concept has a long history in biogeography. Its roots are usually traced to Alexander von HUMBOLDT, who devised the method of mapping isothermals (lines of equal temperature) and observed patterns of change in the distribution of organisms across isothermal gradients. In 1889, American naturalist C. Hart Merriam refined Humboldt's insight over a summer of field research in the varied landscape of the southern Colorado Plateau north of Flagstaff, ARIZONA. There, discontinuities in the composition of plant species occur abruptly and correlate well with changes in altitude. With field notes on plants covering more than 8000 ft (2,438 m) of change in altitude—a cursory examination of the GRAND CANYON extended that range, but incompletely—Merriam developed confidence in a scheme of zonation that he termed “life zones” in 1890. In addition, Merriam believed that small differences in altitude would correlate well with broad differences in latitude. Thus, the rocky, treeless area of the San Francisco Peaks above tree line, which Merriam called the “Alpine” life zone, corresponded with sub arctic regions. Merriam also noticed that boundaries between zones occur at higher altitudes on south-facing slopes than on corresponding north-facing slopes.

## SEVEN LIFE ZONES

Merriam recognized seven life zones. They were, from highest to lowest: Alpine, Timberline, Hudsonian, Canadian, Transition, Upper Sonoran, and Lower Sonoran. The designations of his life zones clearly attest to his belief that the concept was applicable on a continental basis. Contemporary biogeographers and ecologists found Merriam's zones a useful, if incomplete, account of plant succession in geographical space. Over the three decades that followed, ecologists explored patterns of succession over time. The leader in this program of research was Frederick Clements. Clements developed the concept of the “climax com-

munity,” a naturally occurring, interdependent association of plants marking closure for plant succession over time. Although Clements's theory dominated biogeography for many decades, the idea of degree of interdependence in communities was challenged by contemporary biogeographers and ecologists, who argued that communities were contingent associations of plants rather than determinate biological entities in their own right. This latter view of communities has been favored since the 1950s.

## VEGETATION GRADIENTS

Evolution in the concept of plant communities accompanied refinements in the concept of vegetative zones. Today, biogeographers recognize a number of gradients—temperature (across altitude and latitude), precipitation, soils and geology, among others—across which communities vary and can be usefully categorized into vegetative zones. Even so, climate gradients, especially temperature, remain important variables in the geographical distribution of vegetation zones, particularly as biogeographers uncover and monitor effects of global warming. The zone concept has also been useful in monitoring environmental degradation caused by human development and agricultural practices.

Although there is no single classification of vegetative zones on which all biogeographers and ecologists agree, most recognize variations, usually localized, of the following seven zones:

*Alpine and arctic tundra and ice.* This vegetative zone, found at the highest altitudes and latitudes, is all but treeless. Communities are composed of lichens, mosses, grasses, and low shrubs. Alpine tundra and arctic tundra are often considered different zones because arctic tundra plants support a range of migratory animal species and are ecologically more complex. Most of the total biomass in this vegetative zone is found in the Northern Hemisphere, north of the boreal forest.

*Boreal forest.* Composed, often densely, of a few species of coniferous trees, the boreal forest is extensive in the Northern Hemisphere; it covers much of CANADA and most of northern Europe and Asia. The boreal forest also extends along mountain ranges, such as the Sierra Nevada, at lower latitudes. It is usually associated with heavy snow that lingers into the summer.

*Temperate deciduous forest and subtropical evergreen forest.* Dominated by diverse species of summer-green, broad-leaved deciduous trees, this zone occurs in temperate regions wherever precipitation and soils

are suitable. This is the dominant vegetative zone of the eastern United States, along with central to southern Europe. In warmer temperate regions, including southeastern UNITED STATES, CHINA, and JAPAN, the place of these summer-green trees is taken by evergreen deciduous species.

**Temperate grasslands.** A vegetative zone that includes the tall- and short-grass prairies of North America, the steppes of central Asia, and the PAMPAS of Argentina, the temperate grasslands are composed of grasses and associated nonwoody plants. In many places, temperate grasslands have been replaced by agricultural cultivars.

**Desert and semidesert.** Desert vegetative zones are composed of a variety of vegetative types, all of which are adapted to arid and hyperarid regions. These zones are widely distributed around the world, and most occur within 10 degrees of 30 degrees latitude, north and south.

**Tropical deciduous forest and savanna.** Found in the equatorial belt, tropical deciduous forest occurs in regions of moderate rainfall. The continuous canopies of these forests are distinct in composition from the more open canopies of savannas. Differences in climate, the frequency of wildfire, and relative abundance of grazing animals contribute to the distinctiveness of these zones.

**Tropical rainforest.** As the name implies, tropical rainforests occur in regions where temperatures are relatively stable year-round and where precipitation is abundant. Tropical rainforests are species-rich and are highly productive of biomass.

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## Venezuela

**Map Page** 1139 **Area** 352,144 square mi (912,050 square km) **Population** 25,017,387 **Capital** Caracas **Highest Point** 16,427 ft (5,007 m) **Lowest Point** 0 m **GDP per capita** \$4,800 **Primary Natural Resources** petroleum, natural gas, iron ore, gold.



VENEZUELA IS A COUNTRY in northern South America. A former Spanish colony, Venezuela formed part of the country of Gran Colombia after achieving independence in the early 19th century. In 1830, Venezuelan broke away from the other Gran Colombian nations of COLOMBIA and ECUADOR.

The country is slightly smaller than twice the size of CALIFORNIA. The CARIBBEAN SEA and ATLANTIC OCEAN border Venezuela to the north and east. Venezuela also shares borders with BRAZIL, Colombia, and GUYANA. The country can be divided into six geographic regions: the coast, the Segovia Highlands, the ANDES, the coastal range, the llanos, and Guayana.

At the eastern end of the coastal region is the 250-mi- (402-km-) long Orinoco Delta. Consisting of low plains and swamps, the delta provides a natural entryway to the interior of Venezuela. Early European explorers and missionaries used the delta to travel inland. Later, the delta was used to get to the country's mineral resources.

However, because the Orinoco Delta is hot and rainy and possesses few resources, human settlements in the region are scarce. At the western end of the coastal region lies Lake Maracaibo. In the 20th century, the discovery of oil made the Lake Maracaibo region a key part of the country, as petroleum came to dominate the Venezuelan economy. While oil brought much wealth to the region, it also brought many environmental problems.

There are a number of important port cities along the Venezuelan coast. They include Puerto Cabello, Cumaná, and Barcelona. The most import port is La Guaira. While it does not possess the best natural harbor in Venezuela, La Guaira achieved its position because of its location near the capital city of Caracas and its rich agricultural areas. The coastal region also includes a number of islands. Chief among them are Margarita, Coche, and Cubagua. During the colonial period, the islands were an important source of pearl



fishing. By the twentieth century, tourism and commerce played a key role, especially on Margarita.

The Segovia Highlands consist of high plains and low, broken hills, with a relatively hot and dry climate. The highlands are located at altitudes between 1,600 and 2,600 ft (487 to 792 m). Four mountain formations—the Northern, Barbacoas, Baragua, and Lara Mountains—surround two savanna areas, known as the plains of Falcon and the Lara Depression. During the 1500s, European settlers made their way from the coast to the Lara Depression and established a number of important towns, including El Tocuyo and Barquisimeto. These towns in turn served as a base for further exploration of the central Coastal Range. The Segovia Highlands provided land suitable for raising cattle and growing crops, along with a source of Native American labor.

In the Venezuelan Andes, two ranges surround a series of valleys. The highest peaks are located near the city of Mérida and reach 16,400 ft (4,999 m). Most of the main cities and towns, such as Trujillo, Boconó, and San Cristóbal, are located in the valleys at altitudes between 2,600 and 5,380 ft (792 and 1,640 m). An existing native population for labor, fertile land, and a cool climate attracted many settlers to the Venezuelan ANDES. The Andes region of Venezuela has been important historically because of the cultivation of coffee and as a source of political power. In the 19th century, coffee was Venezuela's principal crop and the country was an important exporter. Many national leaders have hailed from the Andes. Notable among them were Cipriano Castro and Juan Vicente Gómez, who ruled the country from 1899 until 1935.

Venezuela's coastal range is the political and economic center of the country. The range is made up of low mountains that are divided into eastern and western sections separated by the Unare basin. The western section, known as the Central Coastal Range, is home Venezuela's principal cities, including the capital of Caracas. Founded in 1567, Caracas quickly became the most important city during the Spanish colonial period. After playing a key role in the struggle for independence in the early 19th century, Caracas became the capital of an independent Venezuela. In the second half of the 20th century, Caracas grew into a major metropolis.

Also known as the Orinoco River plains, the Venezuelan LLANOS consist of tropical grassland, with some woodlands along the rivers. A cycle of draught and floods regulates the lives of those living in the llanos. The rainy season leads to flooding, while the



*Founded in 1567, Caracas quickly became the most important city during the Spanish colonial period.*

dry season often causes shortages of water and grazing land. Traditionally, the llanos has depended on a cattle economy, producing largely for the domestic market. In the early 19th century, the llanos played a crucial role in Venezuela's wars of independence, providing many soldiers to the conflict. In the 20th century, the oil also began to play a role in the region's economy and politics.

The Guayana region can be divided into two parts. The plains of western Guayana follow the Orinoco and Casiquiare Rivers. These plains are largely sandy-soil grasslands with scattered palm groves. These grasslands are fragile and do not support large-scale livestock raising. The rest of the region consists of distinctive, steep, flat-topped mountains. These mountains contain many spectacular waterfalls, including

Angel Falls, the world's highest waterfall. The mountainous regions also possess mineral resources such as iron ore. Guayana has long been a frontier area in Venezuela and was not thoroughly mapped out until the 20th century with the advent of aerial mapping. Ineffective occupation made it difficult for the government to maintain its claims to territory disputed with Great Britain. Indeed, in a boundary dispute with Great Britain in 1895, Venezuela lost a significant amount of territory. The region became more developed in the 20th century with the growth of Ciudad Guayana as an industrial center.

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## Vermont

BOUNDED BY THE Canadian province of Québec to the north, MASSACHUSETTS to the south, NEW HAMPSHIRE to the east, and NEW YORK to the west, Vermont covers an area of 9,609 square mi (24,887 square km) and is located in the westernmost portion of the New England region of the UNITED STATES. Its highest point, Mt. Mansfield, reaches an elevation of 4,393 ft (1,339 m) above sea level, while the state's lowest point, Lake Champlain, is 95 ft (29 m) above sea level.

The name *Vermont* derives from the French words "vert mont," the English translation of which is used as the state's nickname: Green Mountain. Such a name is accurate, as Vermont is predominantly a hilly area with nearly two-thirds of the state covered in forest. The remaining third is covered by uplands, meadows, ponds, lakes, and swampy wetlands. Among these forests, many different species of trees exist. Hardwoods such as basswood, beech, and maple are prevalent throughout the state, while conifers, or needle-leaved plants, can be found in elevations over 2,000 ft (609 m).

The most common animal found in Vermont is the white-tailed deer, which thrives in Vermont's vast forests. Other animals include bears, Canadian lynx, and coyotes, as well as a very sparse population of mountain lions.

Lake Champlain, Vermont's and also New England's largest lake with coverage of roughly 315 square mi (816 square km), serves as the mouth for most of the state's major rivers. These include Otter Creek, the largest river, which flows about 95 mi (153 km) through northwestern Vermont before emptying into the lake. Others rivers that follow the same path, but are comparatively smaller, include the Lamoille, the Missisquoi, and the Winooksi rivers.

Vermont can be divided into six distinct geographical regions. The largest of these, the Green Mountain region, runs north to south in the central portion of the state, and is characterized by the high-peak Green Mountains that rise to several thousand feet above sea level, the most notable of which is Mt. Mansfield. In the north, the range descends into the Northfield, Worcester, and other smaller mountain systems. The Northeast Highlands, located in the northeast corner of Vermont, contain the Granite Mountains. The tallest of these include the Gore, Burke, and Monadnock mountains, all of which exceed 3,000 ft (914 m) in height. Dividing the mountains in the Northeast Highlands are swift-flowing streams. In the southwestern region of Vermont there lies the Taconic Mountain region, which covers only a small portion of the state and extends far beyond into Massachusetts. The region is known as being the second-most mountainous area in Vermont, with Equinox Mountain (3,816 ft or 1,163 m) and Dorset Peak (3,770 ft or 1,149 m) being its highest peaks.

Bordering Lake Champlain in northeastern Vermont, the Champlain Valley is often called the Vermont Lowlands, and contains fertile farmland, accounting for nearly all of the state's dairy industry. Champlain Valley's relatively consistent elevation makes it more habitable than any other region in Vermont, as evidenced by Burlington, Vermont's most populated city, being located there. Covering most of the eastern portion of Vermont is the Western New England Upland, which extends southward into Massachusetts and CONNECTICUT. With the most fertile soil found outside of the Champlain Valley, the Western New England Upland is sometimes called the Vermont Piedmont, because of the plateau-esque landscape that runs from east to west. The Vermont Valley, the southernmost and smallest portion of Vermont, is an area mainly consisting of rivers and river valleys. It takes its name from the fact that it is wedged between the Taconic and Green mountains.

Vermont's climate is typically colder than most of the continental United States, with temperatures nearly

10 degrees F (6 degrees C) below the national average. In the spring, a mud season occurs, in which the remaining snow and ice precipitation from winter melts, damaging the state's roads. This is followed by a cool summer and a colorful autumn, when, due to the abundance of sugar maple trees, Vermont's hills explode into a dazzling array of red, gold, and orange foliage. During the winter, the average temperature is a bitter 21 degrees F (-6 degrees C). With its abundance of snow—in some mountains 100 in (254 cm) falls every year—Vermont is one of the East Coast's premier skiing destinations.

Vermont traces its history back to 1609, when Samuel de Champlain, a French explorer, claimed the area of what is now known as Lake Champlain. Following the Treaty of Paris in 1763, the area was ceded to the British, who battled Revolutionaries until the region was declared an independent republic in 1777. Called New Connecticut initially, Vermont drafted and ratified its own constitution, the first of its kind in North America. In 1791, however, the constitution became obsolete, as Vermont joined the Union as the 14th state.

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## vernacular housing

HUMAN GEOGRAPHERS often distinguish between the natural environment and the built environment. The latter, also known as the cultural landscape, consists of that part of our milieu that has been modified by human action. One category of cultural landscape is created by folk cultures, which are often found in rural areas; such people generally change slowly and in small increments. They may lack the technology required to change. Moreover, they often see no reason to change their traditional ways. Vernacular houses are an important feature of folk culture regions around the world.

Vernacular houses have the following characteristics. They are variable and distinctive in appearance from dwellings in other places; a method for preserving cultural heritage and attracting tourists; worth study-

ing for their diagnostic value; often used for multiple functions such as economic activities; frequently reflections of the owners' religious beliefs; made mostly of locally available building materials; energy efficient and well-suited to local environmental conditions; sustainable with the technology available; and prominent and unchanging features in the cultural landscape.

Because folk cultures typically have lived in isolated places, they have shared ideas infrequently with other groups. A basic axiom of human geography is that isolation promotes cultural diversity. Each folk group, therefore, is distinctive. Their houses vary considerably from group to group. Many visitors think these dwellings are quaint. This fuels tourism by those who wish to visit traditional landscapes different from their own. Visitors should be careful to avoid equating quaintness with backwardness, however. Traditional designs and building methods have been proven for centuries to the extent that it may truly be said, "Tradition is wise."

Some people who live in tourist destinations are starting to more actively maintain vernacular houses, as much to preserve the cultural heritage as to ensure that tourists have a rewarding experience. The New Vernacular Housing Movement in Great Britain is an example of this trend. Some governments have moved to protect folk houses by means of such measures as zoning regulations, building permits, or design review procedures. In MEXICO, owners are limited in the changes they are permitted to make to homes located in national historic districts. Elsewhere, governments have implemented taxation policies designed to ease the burden of historic home ownership.

Human geographers find that houses have considerable diagnostic value. They can tell us a great deal about the way of life of their inhabitants and how these people perceive and respond to the natural environments in which they live.

Vernacular houses may serve as more than just a dwelling. For example, they can function as a place of business for crafters or the center of operations for a farm. Many houses in rural Europe have farm buildings attached to the dwelling, both for convenient access to farm tools and animals and for energy savings. The form or orientation of homes may reflect the religious beliefs of some folk cultures. Many Mexican homes, for example, contain sacred corners or walls, while many villagers in CHINA traditionally used to situate their homes to prevent the entry of evil spirits.

The building materials that people use to construct houses are a consequence of their availability in the





The largest lake in Africa, Lake Victoria is shared by the countries of Uganda, Kenya, and Tanzania.

local environment. Stone, brick, mud, wood, leaves and grass are common choices. The scarcity of wood in arid regions leads many desert dwellers to conclude that they should construct houses with thick walls of stone or adobe mud bricks. Such walls provide protection from heat during the day but radiate heat back into the cold night air of the desert. Forest dwellers, on the other hand, are more likely to select wood as their main building material.

Architectural designs reflect the natural environment. Flat roofs or no roofs at all are sensible choices in regions with low rainfall. People who live in rainy areas, though, logically conclude that steeply pitched roofs are a better choice. Those who inhabit flood-prone tropical rainy areas where temperatures are hot often construct cane-walled houses on stilts. This provides flood protection and allows free circulation of cool breezes beneath the house and through cracks in the walls. Literally thousands of different types of vernacular houses punctuate the landscapes of folk culture regions around the world.

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## Victoria, Lake

WITH AN AREA of 26,830 square mi (69,490 square km), Lake Victoria is the largest lake in Africa and, after Lake SUPERIOR in North America, the second largest lake in the world. At 3,720 ft (1,130 m) above sea level, Lake Victoria is bordered by UGANDA, KENYA, and TANZANIA. It is 209 mi (337 km) at its greatest length and 150 mi (240 km) at its greatest width. Lake Victoria is located between two ranges of the Great Rift Valley on a depression with 250 ft (75 m) at its greatest depth. Also known as Victorian Nyanza and, during the period of Arab influence in the 18th and 19th centuries as Ukerewe, Lake Victoria is fed by a multitude of rivers and streams, the most significant being the Kagera River. Lake Victoria flows into the NILE RIVER and begins a very long journey to the MEDITERRANEAN SEA. The rather shallow but huge lake is located near the equator; evaporation from Lake Victoria is significant and influences the climate of central sub-Saharan Africa. Lake Victoria has hundreds of small islands, especially along its northern (Ugandan) shore. Small fishing villages abound, and many people are supported by an economy based on Nile perches, tilapia, and omena. In the swamps and marshes of the northern shore, the Sitatunga antelope thrive.

### EUROPEAN CONTROL

In 1858, while searching for the headwaters of the Nile River, John Hanning Speke was the first European to see Lake Victoria. The British journalist turned explorer Sir Henry Morton Stanley traveled around the entire lake in 1875. During the late 19th and early 20th centuries, Europeans—principally Britain and Germany—competed for control and influence in this region. During World War I, battles were fought on and about Lake Victoria; Britain defeated the weaker German colonial forces.

The British led the way in the economic exploitation of the Lake Victoria region, which supported coffee, tea and sugar plantations. They introduced the use of agricultural chemicals that eventually threatened the ecological balance of Lake Victoria. As the native peo-



ples gained political independence and the world recognized the impact of past practices on the environment, new governments, assisted by the United Kingdom, introduced measures to correct the imbalances that existed in Lake Victoria. Many species of fish had become extinct; new species were introduced and some of them eliminated additional species.

In 1999 Kenya, Tanzania, and Uganda agreed to reestablish the East African Community (EAC) that had been abandoned in 1977. RWANDA and BURUNDI have expressed interest in joining the EAC, which is focused on improving the lives of the 108 million people who live in the region dominated by Lake Victoria, Lake Kivu, and Lake TANGANIKA. In addition to the planned custom union and common market, the members are dedicated to restoring the environment of the Lakes. Along with the Community of East and Southern African States (COMESA), the new EAC is focused on the new "Great Lakes Region." In addition to restoring the environmental vitality of the lakes, these organizations are interested in the potential for clean hydro-electric power to minimize their dependency on oil and other carbon fuels.

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## Vietnam

**Map Page** 1124 **Area** 204,779 square mi (329,560 square km) **Population** 81,624,716 **Capital** Hanoi **Highest Point** 10,315 ft (3,144 m) **Lowest Point** 0 m **GDP per capita** \$411 **Primary Natural Resources** phosphates, coal, manganese, bauxite.



THE SOCIALIST REPUBLIC of Vietnam was formed into a single country in 1976 when the North and South Vietnam states were united after the withdrawal

of American military, which had been engaged in an anticommunist war since the early 1960s. Vietnam has an elliptical shape that spreads for 1,905 mi (3,219 km) in a north-south direction. It is located in South-east Asia, at the easternmost part of the Indo-Chinese peninsula. To the west lie LAOS and CAMBODIA, and CHINA is to the north. Vietnam has a long coastline to the east adjoining the China Sea.

The Annamite cordillera to the west and Northern Highlands are the most important mountainous areas of the country. The mountains, in general, are rugged and heavily forested. The Red River valley and delta of the north are joined by a narrow north-south coastal plain with the MEKONG RIVER delta in the south; these are essentially agricultural areas. The northern part of the country has a marked winter season. Hanoi, the capital in the north, has an average January temperature of 62 degrees F (16 degrees C), but the south has little monthly variation, with a year-round temperature around 80 degrees F (26 degrees C), like that of Hanoi's summer. The heaviest annual rainfall, over 120 in (305 cm), occurs in the central part of the cordillera, but Ho Chi Minh City (Saigon) in the south and Hanoi receive 77 in (195 cm) and 69 in (175 cm) of precipitation, respectively.

Vietnam's Bronze Age civilization dates back to 300 B.C.E. The Chinese conquered the Red River Delta in 207 B.C.E. and ruled until 939 C.E., imparting significant elements of Chinese culture. An indigenous power of the Chams (Kingdom of Champa) thrived in the west coastal plain from 192 through 1471. The powerful Viets of the Red River Delta migrated southward overpowering the Champs and settling all the way to the Mekong delta.

One-fourth of Vietnam's population lives in urban areas. Ho Chi Minh City is the largest urban area with a population of 4 million; Hanoi has 3 million. The major religion of the people is Chinese Confucian Buddhism, though state-sponsored atheism is widely followed. The government is run as a one-party-rule in a socialist system where the Communist Party controls both the political and the economic apparatus of the country.

Recently, some elements of market economy have been introduced despite some government leaders' apprehension. Vietnam is mainly an agricultural country, with 63 percent of the population engaged in some form of farming. Industries are located mainly in Ho Chi Minh City, Hanoi, and Haiphong areas. Vietnam is a poor country; 37 percent of its population lives below the poverty line.

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## Vinson Massif

VINSON MASSIF IS THE highest peak (16,077 ft or 4,901 m) on the ANTARCTICA continent. It forms the southern outlier of the Sentinel Range, the northern range of the Ellsworth Mountains. The Ellsworth Mountains, divided into the Sentinel Range and the Heritage Range by the Minnesota Glacier, lie in the eastern part of Ellsworth Land, inland from the Ronne Ice Shelf. Vinson Massif is 13 mi (21 km) long and 8 mi (13 km) wide.

The Sentinel Range was first sighted by U.S. aviator Lincoln Ellsworth in November 1935; however, he did not actually sight Vinson Massif itself. Between 1958 and 1961, the U.S. Navy completed ground surveys and aerial photographs of the region from Byrd Station. It is believed that on these reconnaissance flights, Vinson Massif was first sighted. From the data collected, scientists mapped the area, labeling heights and naming peaks throughout the Sentinel Range.

Vinson Massif was named for Republican Congressman Carl G. Vinson of Georgia. From the time of Admiral Richard Byrd's Second U.S. Expedition of 1933–35, Vinson had a great interest in and was a vigorous campaigner for America's official involvement in Antarctic exploration and research. Initially, the peak was calculated at 16,859 ft (5,140 m), using traverse data from the survey of the major peaks in the Sentinel Range. In 1979, these peaks were resurveyed, placing markers on the massif and comparing them to satellite data. As a result, corrected data showed Vinson Massif's height to be 16,062 ft or 4,897 m; however, recent further examination using new satellite data has revealed an additional difference of 15 ft (4 m).

The first ascent of Vinson Massif occurred on December 18, 1966, when the team of Barry Corbet, John Evans, William Long, and Peter Schoening reached the summit. Between December 18 and 20, 10 members of the American Antarctic Expedition, led by Nicholas Clinch, reached the summit in three separate ascents. The 1966 American Antarctic Expedition was organized by the American Alpine Club, under the auspices of the National Science Foundation. It was financially supported by the National Geographic Society and logistically supported by the U.S. Navy.

This expedition also made successful first ascents of many other peaks in the region and is one of few government-supported expeditions to Antarctica organized specifically for mountaineering. From the first ascent, mountaineering has been the major activity on Vinson Massif.

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## Virgin Islands (British)

AN OVERSEAS TERRITORY of the UNITED KINGDOM, and poorer cousins to the U.S. VIRGIN ISLANDS, the British Virgin Islands have looked to their larger and more populous neighbors to the west for much of their economic and cultural influences: most tourists to the islands are from the mainland UNITED STATES, and the islands have used U.S. currency since 1959. But recent British regulation of offshore financial activity and criminal activity in the islands, along with a reputation for stable government, has given the British Virgins a new identity as one of the most attractive places for international investment in the Caribbean.

The British Virgin Islands are grouped around Sir Francis Drake Channel, just to the west of the Anegada Passage, a key deepwater route from the ATLANTIC OCEAN to the CARIBBEAN SEA. The group contains about 36 islands altogether, but only 16 are inhabited. The largest of these are Tortola, Virgin Gorda, Anegada,

and Jost van Dyke. All of the larger islands are volcanic in origin (though long extinct), except Anegada which is a coral and limestone formation. These differences in origin are evident in the topography: the volcanic islands have steep hills and rocky cliffs, while the coralline islands are mostly flat. All of the islands were deforested long ago, though some areas have been replanted with mangoes and palm trees, as well as mangroves. Other places remain dry and desolate.

The hillsides contain water catchment areas to provide fresh water, along with desalinization plants. There is not much agriculture; what is produced is strictly for domestic consumption, not export. But the area's lack of rain is a blessing for tourism. The British Virgins are not developed for large-scale tourism, but prefer to retain an industry based more on up-market tourists—more than half of the visitors to the Virgin Islands charter yachts during their stay. Other visitors are attracted to watersports, sailing, and quietness, especially on the string of smaller islands facing the south coast of Tortola: Norman, Peter, Dead Chest, Salt, Cooper and Ginger. A new cruise ship pier was built in the 1990s in Road Town, Tortola, but was purposefully limited to keep out the largest ships.

The eastern Virgin Islands were first settled by Dutch traders in 1648, but the islands were soon annexed by the British. Most of the population are descended from African slaves brought to work sugar plantations in the 19th century, either here or on other islands of the West Indies. About half of today's population are immigrants from other islands who have come here to find work in the growing tourism industry. A century ago most of the population lived on Virgin Gorda, but the majority has since moved to Tortola, where 80 percent of the population currently lives. Virgin Gorda has the islands' most popular natural attraction: the Baths, where giant boulders form a series of grottoes and pools. Jost van Dyke was a pirate haven for many years and is still fairly isolated, with only about 300 residents. Anegada has even fewer people but is instead the home to large iguanas, green turtles, and flamingos, whose numbers are now protected in a wildlife sanctuary. Anegada is also popular among divers for its numerous (over 300) shipwrecks and pristine coral reefs.

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## Virgin Islands (U.S.)

A TERRITORY OF THE UNITED STATES, roughly 65 km (40 mi) east of PUERTO RICO, these islands were named by Christopher Columbus in honor of the 11,000 martyred companions of Saint Ursula, Las Once Mil Vírgenes. Today, these islands are split into two groups: the largest islands form an organized, unincorporated territory of the United States, while the smaller islands to the east have been a crown colony of the UNITED KINGDOM since the 17th century. Both the U.S. and British Virgins rely heavily on tourism, an industry for which they are well equipped, with plentiful sun, lush tropical vegetation and excellent diving.

The U.S. Virgin Islands are made up of over 50 islands and islets, but only three have much land area or population: most of the population is split evenly between Saint Thomas (28 square mi or 72 square km) and Saint Croix (84 square mi or 215 square km), while a small number live on Saint John (20 square mi or 51 square km). Two-thirds of the island of Saint John is covered by the forests of the Virgin Islands National Park, on land donated by the Rockefeller family in 1956.

The islands are volcanic in origin and are mostly hilly, with little flat land. There is not much variation in seasonal temperatures, and although there is a rainy period in summer, the islands receive insufficient water, which must be imported from Puerto Rico. The islands are also frequently in the path of tropical storms and occasional earthquakes. The heavily indented coasts make fine natural harbors and coves—Charlotte Amalie, on Saint Thomas, is considered one of the best natural deepwater harbors in the CARIBBEAN SEA.

It was these harbors and the islands' strategic position along the Anegada Passage, the widest deepwater channel between the ATLANTIC OCEAN and the Caribbean, that first attracted the European colonial powers to these islands. Hoping to keep up with his larger neighbors, the king of DENMARK authorized the establishment of a Danish West India Company, which set itself up in the harbors of Saint Thomas and Saint Croix in the later part of the 17th century. As on other

islands of the West Indies, some sugar plantations were established (especially on Saint Croix), but the ports of Christiansted and Charlotte Amalie became prominent not as sugar exporters, but as major trade centers, not just for sugar, cocoa, or tobacco, but in African slaves. English, not Danish, was generally the lingua franca, and the islands today reflect a mixture of English, Danish, French, Spanish, Dutch, and African cultural influences.

The Danes were the first to abolish the slave trade, in 1802, and the islands lost their economic importance to Denmark. The United States began to show interest from the 1870s, as plans were laid for the building of the PANAMA CANAL. As the Anegada Passage was one of the principal approaches to the canal (completed in 1914), the U.S. saw the need to protect this crucial shipping lane and bought the islands from Denmark in 1917, for \$25 million.

Today, most of the sugar plantations on Saint Croix are closed, but the islands still produce their famous bay rum. Charlotte Amalie focuses on tourism and, as a free port, has a developing offshore finance industry. Other industries are concentrated on Saint Croix, notably petroleum refining—with one of the largest refineries in the world—but also production of bauxite, rum, textiles, and pharmaceuticals. These industries, along with 2 million visitors a year, give the U.S. Virgins one of the highest standards of living in the Western Hemisphere. The islands gained additional autonomy in internal affairs in 1993, but there is no move toward further independence from the United States.

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## Virginia

NAMED FOR QUEEN Elizabeth I of England who was known as the Virgin Queen, the Commonwealth

of Virginia is officially known as The Old Dominion State. The state is also frequently referred to as the “Mother of Presidents” because eight presidents were born in the state, including George Washington and Thomas Jefferson. Jamestown, on the banks of the James River, was one of the first settlements in North America. Virginia is bounded on the north by WEST VIRGINIA and MARYLAND, on the south by NORTH CAROLINA and TENNESSEE, on the west by West Virginia and KENTUCKY, and on the east by MARYLAND and the ATLANTIC OCEAN.

The Potomac River flows along the northeastern boundary of the state, and the Chesapeake Bay separates the land along the eastern shore from the rest of the state. The total area of Virginia is 42,769 square mi (110,771 square km), ranking the state 35th in size. Virginia ranks 12th in population among the 50 states. Virginia’s largest cities are Virginia Beach, Norfolk, Chesapeake, Richmond (the capital), Newport News, Hampton, Alexandria, Portsmouth, Roanoke, and Lynchburg.

Approximately 3,171 square mi (8,212 square km) of Virginia are covered by water, and Virginia’s coastline runs for approximately 112 mi (180 km). The state’s major rivers are the James, the Rappahannock, the Potomac, and the Shenandoah. Virginia’s major lakes are the Atlantic Intracoastal Waterway, the Gathright Dam on Lake Moomaw, the John H. Kerr Reservoir, the John W. Flannagan Reservoir, Pound Lake, and Philpott Lake. The average elevation of Virginia is 950 ft (289 m) above sea level. The highest point in the state is 5,729 ft (1,746 m) at Mount Rogers, and the lowest point is sea level, where the land meets the Atlantic Ocean. The state is approximately 440 mi (708 km) from east to west and approximately 200 mi (322 km) north to south.

The climate of Virginia is humid subtropical through most of the state, but the northwestern section of the state is humid temperate. The area within the Atlantic Coastal Plain tends to have fewer hot and cold days than the rest of the state, resulting in a longer growing season. Snow is also less frequent in this area. The Cumberland Mountain area experiences more cold days and greater snowfall than other regions in the state. Overall, Virginia’s temperature ranges from 25 degrees F (-4 degrees C) in the winter to 89 degrees F (31 degrees C) in the summer. Annual precipitation ranges from 36 in (91 cm) to 50 in (127 cm). Hurricanes are infrequent and tornadoes are rare in Virginia.

Virginia is made up of five distinct geographic areas. The Atlantic Coastal Plain, an area of sands,



silts, and clays, comprises approximately one-fifth of the state, running north to south along Virginia's shore for 100 mi (160 km). This infertile area, which is generally referred to as the Tidewater, is filled with numerous salt marshes and swamps, including a section of the Great Dismal Swamp. The mainland in the western part of the Atlantic Coastal Plain is separated from the area known as the Eastern Shore, which forms the southern portion of the DELMARVA PENINSULA, by the Chesapeake Bay. The land east and south of the Chesapeake Bay is flat, never reaching more than 100 ft (30 m) above sea level. In the western section of the Atlantic Coastal Plain, four necks (peninsulas) are separated by estuaries that run into the Chesapeake Bay. The area also includes hills that may be up to 300 ft (91 m) high.

The entire central section of Virginia is located within the Piedmont Plain, where elevations range from 200 ft (61 m) above sea level in the eastern section to 900 ft (274 m) in the western section. At its narrowest point, the Piedmont Plain is only 40 mi (64 km) wide, but it expands to 140 mi (225 km) as it reaches the North Carolina border. At the Fall Line, where the Piedmont converges with the Atlantic Coastal Plain, low waterfalls and rapids abound. The soils of the Piedmont tend to be only moderately fertile.

In the east, the Blue Ridge Region of Virginia with its narrow strip of metamorphic rocks rises steeply from the Piedmont to meet the Appalachian Ridge and Valley Region in the western section of the state. Land in the southern section ranges from plateaus with valleys and deep ravines to the high peaks of Mount Rogers. The Appalachian Ridge and Valley Region extends along Virginia's western border. This area, known as both the Great Valley and the Valley of Virginia, nestles against the Blue Ridge Mountains.

The well-known Shenandoah Valley is the largest of the valleys within the region. Caverns naturally carved from limestone and shale are found throughout the area. The Appalachian Plateau, which extends from the southwestern section of Virginia into Kentucky as the Cumberland Plateau, is filled with rivers, streams, and forests. The average elevation in the area is 2,000 ft (610 m). The Cumberland Mountains share some characteristics with the Appalachian Ridge and Valley Region; but the plateau is dominated by uplands rather than valleys.

Forests make up approximately three-fifths of Virginia's land. Oaks and pines fill the forests of the Atlantic Coastal Plain and Piedmont Plateau, while oak tulips, beech tulips, and maples are found in the west-

ern section of the state. Other Virginia trees include the dogwood (the state tree), red and white chestnut, willow, oak, shagbark, pignut, bitternut, hickory, and loblolly, Virginia, short leaf, and pitch pines.

Flowers include the dogwood (the state flower), mountain laurel, rhododendron, trailing arbutus, and violet. Animals found in Virginia include white-tailed deer, red and gray fox, raccoon, skunk, opossum, cottontail rabbit, groundhog, squirrel, and muskrat. Black bear are found in Virginia's mountain areas. Winters find the Chesapeake Bay area full of various kinds of migratory birds. The state has 15 state forests and 34 state parks.

Agriculture dominated the economy of Virginia until the 20th century, when it was supplemented by mining, tourism, trade, and government jobs. One-third of Virginia's jobs are in the service sector, including a large number of jobs in computer and data processing centers. Manufacturing industries include transportation equipment, electronic equipment, textiles, apparel, lumber, wood products, furniture, chemicals, and food processing. Virginia ranks in the top 10 of American states in the production of tomatoes, tobacco, peanuts, apples, summer potatoes, sweet potatoes, snap beans, and turkeys and broilers. The dairy industry is also essential to Virginia's economy. Virginia is a top producer of coal. Other minerals include various kinds of building stone, limestone, sand and gravel, natural gas, lime, clay, zinc, kyanite, feldspar, gypsum, talc, uranium, and vermiculite.

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## virtual geography

THE INTERNET TOGETHER with a new generation of related computer software and hardware is producing a revolution in how we conceptualize and interact with geographic places and spaces. This revolution is sustained by the continual diffusion of information and communication technologies (ICT) into many segments

of a globally connected society. These ICT forms include immersive multimedia, video conferencing, computer-aided design (CAD), electronic surveillance, consumer profiling, and virtual realities. Virtual geography refers to the creation of artificial geographies for communication and interaction purposes using concepts from the field of virtual reality (VR).

Virtual reality is the general name given to a wide range of computer-based approaches for visualizing objects and spaces in three or more physical dimensions (distances, height, and time). Some regard VR as a technology for interacting with multidimensional databases, while others view it as a way of integrating humans and information. Nevertheless, VR is distinguished from computer-aided design and GEOGRAPHIC INFORMATION SYSTEMS (GIS) in that the end user experience is an interactive and immersive one. The end user is able to move around the digital space created within the VR world and may interact with the objects found. Recent software systems integration seems to suggest that VR capabilities are now gradually being incorporated into GIS software packages to support visualization and information communication.

The virtual reality experience can be delivered in many ways. The world may be projected within “caves or sheds” consisting of display screens that surround the field of view of the user and within which the user can move. Specially designed stereoscopic glasses, head mounted display (HMD) units with screens positioned directly in front of the eyes, and gloves may also be used to experience the virtual world and to touch virtual objects. The downside of these forms of delivery is cost. Hence, they are more commonly used in research and high-end simulation environments. The most widely used forms of VR delivery systems is the desktop computer where the virtual worlds are displayed on the computer monitor and navigation is achieved with the mouse and keyboard. Moreover, the desktop virtual worlds can be transported and distributed using CD-ROMS or the internet with minimal skills needed to implement or use them. The only requirement is usually a viewer or plug-in program that in many cases is freely available.

The amount of interaction and immersion that is permitted in the VR world is dependent on the design and the hardware devices used in the interaction. In a fully immersive environment, a number of computer devices transform the user actions into activity in the VR world. Depending on the devices available, the interactions can simulate sensations such as cold, heat, or resistance. In a partially immersive environment, the

user remains aware of the real world during the interactions. Desktop virtual worlds are an example of partially immersive environments. In augmented reality systems, the user is in an environment where elements of the real world and virtual world complement each other through graphical information. The VR world serves as an interface and host to the user during interactions with the artificial world of the computer graphics. The user may take on many forms, such as a whole body (an avatar), part of a body, or a controllable viewpoint. The design may include the possibility for users to control and use objects in the virtual environment.

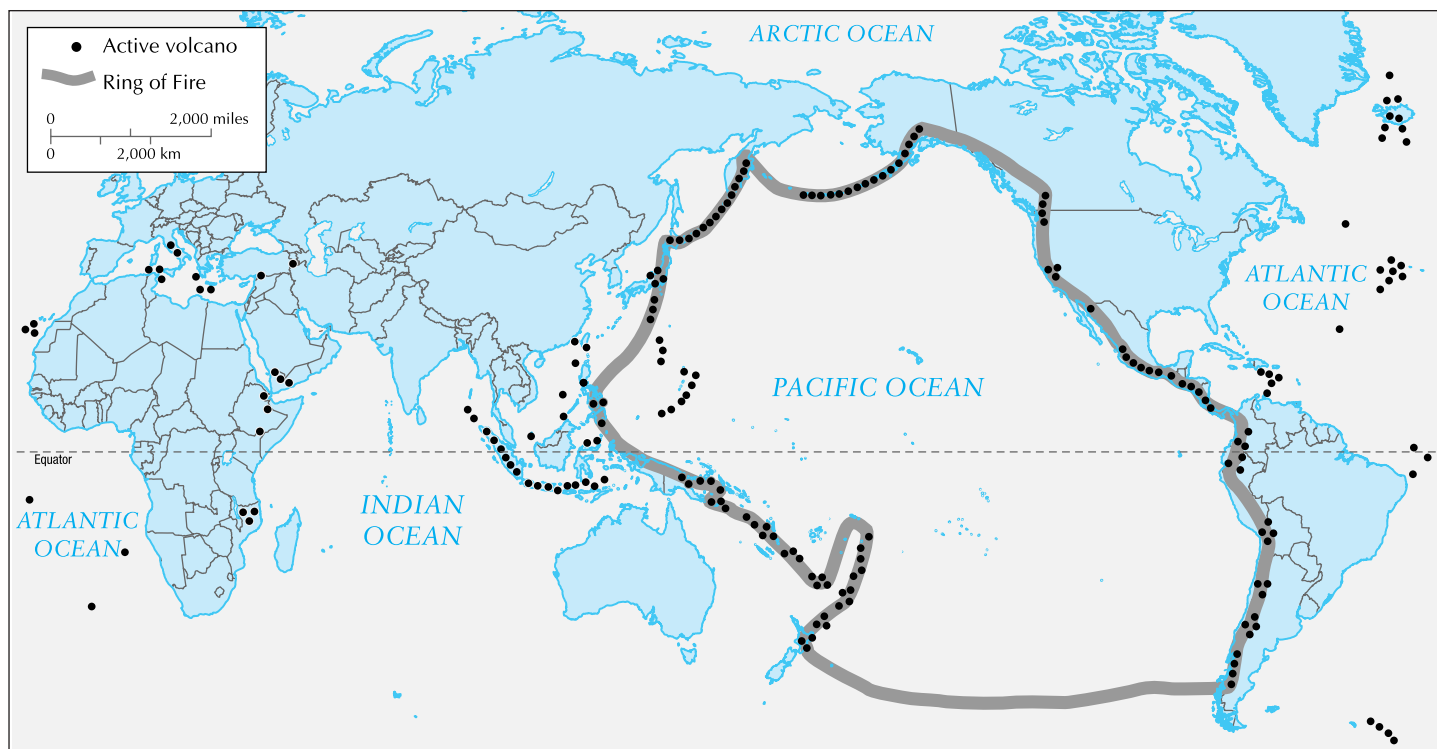
Virtual reality systems are being used in many contexts such as in training, education, simulation, visualization, navigation, gaming and game design, and entertainment. Application areas of VR in geography include virtual cities, landscape visualization, virtual field courses, and visualizing abstract concepts and models of reality. Although the technology has demonstrated its utility in these environments, issues such as end-user requirements, navigation conventions, degree of realism, extent of interaction, and user expectations remain. Of importance, too, are the philosophical debates and implications of the dichotomy and boundary (if any) that exist between the real and the virtual.

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## volcanoes

A VOLCANO IS ANY vent on the surface of the Earth, or another world, which allows molten rock, ash, steam, gas, or pyroclastic debris to spill out. Volcanoes proliferate along the edges of the Earth’s tectonic plates, and are found on other satellites in our



Most of the world's active volcanoes are located along the Pacific Ring of Fire, where the boundaries between shifting plates are called plate-boundary volcanoes. These range from New Zealand to the Aleutian Islands to Oregon to Chile.

solar system, such as Io, one of Jupiter's moons. In a volcano, a tunnel or conduit allows magma from below the Earth's surface to flow upward to the vent, where it may erupt in the form of flowing lava, flying projectiles, or clouds of steam, gas, and ash (fragmented lava). The vents occur under water or on land. Lava flowing under water cools and often forms "pillows" of basaltic rock several meters in diameter. On land, a cone can build up around a vent; the cone is formed of the ash and lava that erupts and then cools. A caldera is created at the top of a volcano when an explosion causes the roof of a magma chamber to collapse upon itself and cool. This forms a depression. Crater Lake in OREGON is an example of a freshwater lake lying in the huge caldera of an inactive volcano.

There are many ways to classify volcanoes, but none cover all the variations. Morphologically, 90 percent of all volcanoes fall into six categories. First, over 60 percent of volcanoes are strato volcanoes, or composite volcanoes. These are often steep mountains formed by viscous lava flows of andesite and dacite. Strato volcanoes are explosive, and about half the product expelled from them is pyroclastic material, the other half lava. Mount St. Helen's in WASHINGTON

State, Mount Fuji in JAPAN, and Mount Pinatubo in the PHILIPPINES are famous examples of these.

Shield volcanoes, such as Kilauea and Mauna Loa in HAWAII, are made of the basalt formed from fluid lava flows. They are large, less explosive, and not as steep as strato volcanoes. A third type is the rhyolite caldera complex, the most explosive. Rhyolite caldera complexes don't look like volcanoes; they self-destruct during their eruptions and usually leave nothing but a crater or caldera and debris behind. The last eruption of this type was Taupo, NEW ZEALAND, in 83 C.E.

Another form of volcano, the monogenetic field, is caused by a low supply of magma. No mountain or cone builds up from the vent of this volcano, and new eruptions often form new vents. MEXICO has several monogenetic fields. Flood basalt volcanoes consist of basalt lava flows up to 40 mi (50 km) thick and hundreds of miles long, in which slow-moving lava builds up the flow. The Columbia River basalt province in the northwest United States is an example of this. The last common type of volcano is the mid-ocean ridge, a submarine volcano that occurs along the oceanic plates. In fact, the mid-ocean ridge builds those plates, by expelling lava between two plates.

Another common division of volcanoes puts them all into two types: fissure and central. Fissure volcanoes occur along fractures in the Earth's crust and eject basaltic lava; they are rarely explosive. Central volcanoes develop into cones, with a central vent guiding magma upward.

Volcanoes have been responsible for incredible devastation. In 1815, Tambora Mountain on the Indonesian island of Sumbawa erupted for 10 days and killed 56,000 people. The explosion was heard and felt 1,000 mi (1,609 km) away. Besides the 12,000 killed by the blast itself, 44,000 people on the island of Tombock, 100 mi (160 km) distant, died of starvation when all vegetation and animal life was extinguished by being buried in ash. Although Tambora was not quite as powerful as the more famous 1883 Krakatau eruption, it is estimated that Tambora ejected 20 times more debris into the air. The world temperature was affected for three years; frost covered the southern UNITED STATES on the Fourth of July that year. The year 1816 was called a year without summer, and crop failures resulted in food shortages in Europe and North America through 1819.

Besides the immediate threat to human, animal, and plant life, volcanic eruptions are a major source of air pollution, and some research links volcanic eruptions with EL NIÑO events and other global climatic effects. The gas most commonly expelled by a volcano is steam; water is contained in the magma that pushes up from below the surface. Some volcanologists believe that all new water on Earth comes from volcanoes. By volume, carbon dioxide is the second most common gas from volcanoes.

The 1982 eruption of the El Chichón volcano in the state of Chiapas, Mexico, released 30 million metric tons of carbon dioxide, a greenhouse gas, into the atmosphere. Since carbon dioxide is heavier than air, it can collect in low clouds and kill many people and animals during eruptions. Sulfur dioxide, a component of acid rain, is the third most common gas resulting from a volcano and contributes to global cooling for several years after a large eruption. Between 1980 and 1988, Mount St. Helen's emitted about 2 million tons of sulfur dioxide—half of this in the major eruption of May 18, 1980.

Volcanoes exist on other worlds as well. Domes, cones, basalt plains, and other volcanic features have been identified on the moon, although the volcanic activity that produced these occurred 3 to 4 billion years ago. Mars has shield volcanoes larger than Earth's, but the volcanoes have not been active for over a billion

years. Thousands of volcanoes dot Venus; whether they are active is not known. None of these worlds show evidence of plate tectonics, which is closely associated to volcanoes on Earth. By far the most interesting spot in the solar system for volcanologists is Io, a moon of Jupiter, where 356 calderas were identified by the *Voyager* and *Galileo* spacecraft in 1979 and 1995. Earth-based telescopes and satellites now monitor the volcanic activity on Io.

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## Volga River

THE VOLGA RIVER is considered to be the mother of Russian rivers. Europe's longest, it drains an area of 550,288 square mi (1,410,994 square km), roughly 40 percent of European RUSSIA. From its origins in the heavily forested hills near the Baltic Sea to its mouth on the CASPIAN SEA 2,300 mi (3,700 km) away, the river passes through much of the heart of historic Russia.

The course of today's Volga has been significantly altered by the creation of a succession of hydroelectric dams and enormous reservoirs, built by the Soviets between the 1930s and 1960s. The largest of these, the reservoir of Samara (known in Soviet times as Kuybyshev), backs up waters of both the Volga and its chief tributary, the Kama, for 375 mi (600 km), covering an area of 2,300 square mi (5,900 square km). The river is now a chain of inland seas with sluggish currents and brown murky waters. The dams and reservoirs, though under heavy attack from environmentalists, continue to provide electricity and irrigation to vast regions of central Russia, while its waterways, locks and canals are important as Russia's largest inland water transportation network, carrying roughly two-thirds of all river commerce. Boats can travel nearly the entire



length of the river and by means of canals, can connect to other river networks, thus linking the Volga basin to the ATLANTIC and the MEDITERRANEAN via the Baltic and BLACK seas.

For much of Russian history, the Volga has served as a boundary between east and west, between Slavs and Orthodox Christianity, and the nomadic “barbarians” of Siberia and the steppes of Central Asia. Cities like Kazan and Astrakhan began as Mongol strongholds, but were taken by Russian forces during the 15th-century expansion eastward. New cities were built on its lower courses, such as Tsaritsyn (the city of the czar), which was later renamed Volgograd, then Stalingrad, site of one of Russia’s bloodiest battles in World War II. The ancient Russian capital of MOSCOW is not on the Volga itself, but the Moscow River flows into its second-largest tributary, the Oka River. A canal was built in 1937 to make Moscow a port for the first time in its long history.

The Volga is remarkably flat from source to mouth, dropping only 630 ft (190 m) from the Valdai Hills (roughly halfway between Moscow and SAINT PETERSBURG) to the depression of the Volga Delta at the Caspian Sea. This depression is one of the lowest spots in Europe, falling to 92 ft (28 m) below sea level. The climate and vegetation change dramatically along the river’s course, however, from dense northern forests to steppe and semidesert in the south. The last segment of the river (below Volgograd) actually has less flow per second (dropping from a high of 295,814 cubic ft or 8,380 cubic m per second), because of the lack of tributary streams and high evaporation from the sun. The river’s delta is wide and is home to one of Russia’s prime exports, caviar from enormous Volga sturgeon. This industry and others are disturbed by environmental problems: heavy metallic content in the reservoirs and drop in water levels due to irrigation and evaporation. There is growing concern among the 60 million people and about half of Russia’s industry and agriculture that depend on the river.

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## Von Thünen, Johann H. (1780–1850)

JOHANN HEINRICH von Thünen was an important theorist in the science of land use. His work brought together the fields of economics and geography to provide an illustration of the balance between land cost and transportation costs. Although his land system was designed to calculate optimal distribution in the context of preindustrialized Europe—before the development of railroads, for example—the equations and principals he developed remain the foundation of much of land management practices today, particularly in the developing world. The Von Thünen Model helps economic planners analyze the question: what effect does distance have on costs for economies at different locations?

Von Thünen was a wealthy landowner from the Grand Duchy of Mecklenburg, a state in northeast GERMANY. Much of his life was spent managing his estate, Tellow, apart from his time spent at the University of Göttingen, in central Germany. His primary work is entitled *Der isolirte Staat* (*The Isolated State*), published in several stages, volume one in 1826, volume two in 1850 and 1863, and volume three in 1863. The first volume was one of the first treatises to deal with spatial economics, relating productivity and profit to distances required for transportation of raw materials and goods to markets. His model was based on a series of concentric circles, defining which sorts of economic activity would be most suitable at different distances from the center of a theoretical, isolated, state. The later volumes refined this idea and focused on the marginal productivity theory of distribution in a mathematically precise way. Areas on the margins of a city-state were seen as naturally the least productive, because of higher costs of transport, and lower population density, requiring higher wage costs.

The Von Thünen Model describes a city located centrally within an “isolated state” that is self-sufficient and has no external influences. The model relies on the theoretical state in which all of the land is geographically uniform, with no physical barriers to production or transport except distance from the center, and in which the soil and climate are uniformly consistent. The ring of the model closest to the city (where most of the population lives) would be developed for intensive farming and dairying, followed by a ring of forest, a ring of extensive field crops, and finally, ranching and animal products, before reaching the

wilderness that surrounds this model state. This system would ensure that the products that needed to get to market most quickly (fruits, dairy) could do so, while more durable agricultural products (grains) could travel more slowly. Timber and firewood from the forest band would be needed for fuel and building, but because of their heaviness would be located as close to the city as possible to reduce transport costs. Similarly, the animal husbandry belt is located farthest away from the center because animals are largely self-transporting, again, reducing transport costs.

The model also has an objective function of maximization of rent per unit of land, as directly related to transportation costs to centrally located markets, and the impact of alternative markets set up in the periphery, the margins of the isolated state. The closer to the city, the higher the price of land. Much of the model's application today pertains to the productivity of the

marginal areas, those farthest away from the populated and industrialized centers of the world. As globalism brings transport costs down, economic geographers are currently using von Thünen's ideas to determine what effects the rising welfare of the marginal areas will have on the economic health of those traditionally at the heart of productivity.

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## wadi

A WADI IS A RAVINE or gully in the MIDDLE EAST or northern Africa that is dry for most of the year. The word *wadi* means “valley” or “ravine” in Arabic. When the rainy season comes, great quantities of water may rush through the wadis, destroying lives and property. Most of the year, wadis are either dry or have intermittent stream flow. They can range in size from small gullies to large, deep canyons. An inverted wadi is a formation with ridges that follow the floor of the former wadi. The tops of the ridge mark where the floor of the wadi once was. The material on both sides of it has been washed away, but because it was mostly gravel, the wadi floor remained and is now raised.

Wadis are usually found in DESERTS, which are generally considered to be areas that have less than 10 in (250 mm) of precipitation a year. Often the sides of the wadi are undercut by the swiftly moving water that has rushed through. The wadi floor is usually covered with silt and has rounded boulders that have been tumbled smooth by the motion of the water. A heavy rain often produces a flash flood in which rock debris and sediment from the wadi floor are carried along with the water. A huge amount of sediment can be moved in a short time during a flash flood. The water foams, because of trapped air bubbles. At the point where the wadi emerges from the hills onto the plain, the water

slows down and the sediment it is carrying is deposited in the form of an ALLUVIAL FAN. Heavier materials are dropped first, and the finest material travels the farthest. The water may spread into a PLAYA lake.

Some wadis contain sparse vegetation along their channels. Acacia trees grow along narrow rock wadis in the NEGEV DESERT in southern ISRAEL. In the Libyan Desert, the only vegetation outside oases is found in the wadis. Types of vegetation there include grasses, shrubs, and several varieties of acacia trees. Seeds can be distributed by floodwaters. Wadis serve as breeding places for certain wildlife. The desert locust breeds in wadis in northern Africa, Arabia, and Southwest Asia. Shallow, bushy wadis in the Negev Desert are a prime breeding place for the spectacled warbler. The red fox lives near wadis in Arabia.

Wadi Rum, in the Middle East country of JORDAN, was formed differently from most wadis. Geologists believe that an enormous upheaval in the Earth's crust shattered huge pieces of rock and resulted in a deep crack in the Earth's surface that became Wadi Rum. Scientists believe the area has been inhabited since the 8th century B.C.E. The Central Plateau of SAUDI ARABIA, called the Nejd, is deeply cut by wadis that were formed by temporary streams that carried water only after a rain.

In October 2003, torrential rains in the western SAHARA DESERT in MOROCCO caused the creation of new

wadis and widespread flooding. In many desert areas, manmade terraced wadis are being built to divert flash flood waters to adjacent fields. Also runoff waters are collected in natural depressions for use later.

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## Wallis and Futuna Islands

THE WALLIS AND FUTUNA ISLANDS (overseas territory of FRANCE) are a collection of tiny islands in the South PACIFIC OCEAN. Consisting of three hereditary kingdoms, its government is an anomaly as an integral part of the French Republic, but there is little impetus for change, in either traditional government or its affiliations with France.

Part of an arc of islands stretching from the MARSHALL ISLANDS in the north across the island chains of KIRIBATI and TUVALU, all the way to the Samoan islands, Wallis and Futuna fit snugly within the wider sphere of Polynesian language and culture. FIJI and TONGA lie close as well, to the west and south. The islands are volcanic in origin, with fringing reefs. They are heavily deforested. Uvéa (Wallis) is the largest of the group (40 square mi or 102 square km), with the capital, Mata-Utu, and about two-thirds of the population.

A shallow caldera of an extinct volcano is filled by a lake whose water levels rise and fall with oceanic tides, indicating subterranean links with the sea. Roughly 125 mi (200 km) to the southwest, the Îles de Horne include Futuna, divided between two kingdoms, Alo and Sigave, and Alofi, which is uninhabited because of a lack of fresh water. Futuna has a much higher peak than any of the other islands: Mount Singavi, which rises to 2,525 ft (765 m). It is newer than the other islands, and more geologically active—it frequently feels earthquakes, and has no fringing reef.

The natives of Uvéa (Wallis) and Futuna were probably settled from different directions: Uvéa from Tonga and Futuna from Samoa, and the two groups re-

main divided along these linguistic lines. Spotted by Dutch and British explorers in the 17th and 18th centuries, the islands were given their European names: Hoorn for the Dutch town, and Wallis for the British captain Samuel Wallis (who also discovered Tahiti). The islands were mainly left to themselves until the arrival of French missionaries in 1837. A de facto protectorate was established in 1842 and formalized in 1887, but in reality authority was held by a Catholic bishop.

In 1913, it was declared a colony, but after World War II all of the French colonies were given the opportunity to revise their status, and Wallis and Futuna voted to become an overseas territory in 1959, giving the populace full citizenship, health care, education and retirement pensions. The government is a mixture of traditional and modern, with a governing council of the three kings and three French-appointed delegates, and an elected territorial assembly. The islands send a member to the French Senate and the National Assembly.

These ties are important to ensure heavy subsidies from the French government and continued access to the nickel mines and plantations on NEW CALEDONIA, where many Wallisians have sought work—about 8 percent of the population (17,000 people) of New Caledonia are Wallisians. Remittances from such émigré labor provides a good deal of the islands' revenue. Local industries are very small, including coconut farms, handicrafts, and fishing.

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## Washington

THE STATE OF WASHINGTON in the northwest UNITED STATES has an area of 71,303 square mi (184,674 square km) and a population of 5,894,121



(2000). Bordered by OREGON to the south and CANADA to the north, Washington State boasts a dramatic range of geographic diversity, including dense forests, mountain ranges, an ocean coast, and arid farmland. The capital is Olympia and the highest point is Mount Rainier, at 14,410 ft (4,392 m).

The state can be divided into six distinct geographic areas, three of which are tremendously mountainous: the Olympic Mountains, the Coast Range, the Puget Sound Lowlands, the Cascade Mountains, the Columbia Plateau, and the ROCKY MOUNTAINS.

The westernmost geographic area, the Olympic Mountains, is bordered by the PACIFIC OCEAN and, to the north, the Strait of Juan de Fuca. The bulk of this area lies within the protected borders of the Olympic National Park, much of which is inaccessible and preserved as wilderness areas. This region of the state includes Mount Olympus, the highest peak in this region, at (7,954 ft or 2,424 m). Further down the western coast are the Willapa Hills, some of the lowest mountains on the Pacific Coast. To the east lie the Cascade Mountains, forming a 700-mi (1,126-km) chain that encompasses the highest point in Washington, Mount Rainier, as well as several other high volcanic peaks, including Mount Adams (12,307 ft or 3,751 m), Mount Baker (10,778 ft or 3,285 m), and Glacier Peak (10,541 ft or 3,212 m). Also notably included in this chain of mountains is Mount St. Helens, which famously erupted in 1980. Finally, the Rocky Mountains run through the northeast corner of Washington State.

Both the Puget Sound Lowlands and the Columbia Plateau contain much of the state's farming and agricultural lands (Washington State contains approximately 37,000 farms). While wheat is one of the state's prime income-producing crops, Washington is also known for its fruits, being the country's leading producer of apples. The Columbia Plateau itself is crossed by both the Columbia River, running along the border between Washington and Oregon, and the Snake River.

Prior to colonization, Washington State was inhabited by a variety of Native American tribes, including the Nez Percé, Yakima, Nooksak, Chinook, Nisqually, and Quinault, among others. (Approximately 30 registered Native American tribes continue to call Washington State home, with reservations found throughout the state.)

In 1775, however, Spanish explorers reached Washington State, claiming it for SPAIN. Explorers LEWIS AND CLARK followed shortly thereafter, following the Snake and Columbia rivers to the Pacific Ocean. Through a series of trade and settlement agreements,

ownership of Washington changed hands several times, including a period of time (from 1818–46) when Washington State was jointly owned by the UNITED STATES and Great Britain. Washington eventually became an independent territory in 1853. Following the completion of the Northern Pacific and Great Northern rail lines, on November 11, 1889, Washington became the 42nd state to join the Union.

Washington's early industry revolved around agriculture and lumbering. With the construction and growth of the transcontinental railroad (and the entire railroad industry), not only did the lumber industry grow, but transportation (shipping) took on an increasingly important role. Recent history has seen the growth (and subsequent decline) in the computer and software industry, based in large part in the greater Puget Sound area around Seattle and Redmond (home to Microsoft). This time period (1970s–80s) also saw a tremendous population boom, particularly in the greater Puget Sound area. Contemporary Washington industry continues to revolve around software and computer technology, as well as aviation and agriculture.

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## weather

THROUGHOUT HISTORY, humankind has always been in awe of the weather. Ancient civilizations considered it to be the work of the gods. Even as recently as the 1700s, it was thought that weather occurred in only one place and simply stayed put. Benjamin Franklin was one of the first who published his speculations that this was untrue when he learned that a storm he experienced in Philadelphia, PENNSYLVANIA, was followed by a suspiciously similar one in Boston, MASSACHUSETTS the next night.

In the years that followed, forecasts continued to be based on folk knowledge as well as emerging sci-

ence, such as the observations of courageous balloonists who went aloft in search of approaching storms. With the progression of technology, instruments were sent aloft instead. Today, SATELLITES do much of the work of watching weather patterns. Weather information-sharing takes place on a global level. Many countries' weather forecasts incorporate data gathered by U.S. satellites, which are shared with the entire world—even during times of disagreement.

Weather plays a big part in our daily lives. It affects many of the things that we do, from the clothes we wear and the food we eat to where we live and how we travel. As a result, weather is of great interest to people everywhere, from meteorologists, the scientists who study it in great depth, to ordinary citizens pursuing everyday lives. A safe topic of polite conversation is always the weather, particularly in areas where the weather is changeable and unpredictable.

The cowboy philosopher Will Rogers once commented about the constantly changing weather in his native OKLAHOMA: "If you don't like the weather, wait ten minutes." Such change is not exclusive to Oklahoma. Hawaiian rental car operators chuckle at the familiar site of newly arrived tourists driving away from the airport only to stop suddenly and jump out of the car to snap photos of a rainbow. The newcomers do not realize that Hawaii's weather can vary on opposite sides of the street—with sunshine on one curb and rain on the other, and lots of resulting rainbows.

### WHY DOES WEATHER CHANGE?

We live and breathe in a blanket of air known as the atmosphere. The atmosphere is constantly moving and changing all around the Earth. In some locations, weather factors such as temperature change very little, such as in the mountains of Central America. There, high altitudes and proximity to the equator keep temperatures within a narrow range; 50 degrees F (10 degrees C) is regarded locally as quite chilly and 80 degrees F (26 degrees C) as extraordinarily hot.

In the darkest regions of deep space, the temperature is a frigid -450 degrees F (-267 degrees C). Closer to the sun, temperatures reach thousands of degrees. Yet on our planet, the temperature seldom drops below -50 degrees F (-45 degrees C) even on the North or South Pole. In the most arid areas, it rarely rises above 130 degrees F (54 degrees C). What makes Earth's climate so moderate? Separating Earth from the extremes of space is a 500-mi- (805-km-) thick blanket of gases, the atmosphere. Most planets have an atmosphere, a layer of gases that surrounds them. Jupiter and Saturn

appear to be mostly atmosphere. Mercury has very little atmosphere since it is so close to the sun and its gases are burned away. Pluto appears to have very little atmosphere since it is so cold and the gases have frozen and accumulated on the surface of the planet. Our moon also has virtually no atmosphere. However, Mars does, as evidenced by the airborne dust that gives the planet its reddish hue. Its thin atmosphere does not protect it as well as Earth's, with resulting temperatures ranging from frigid at the Martian poles to a comfortable 80 degrees F (26 degrees C) at the equator. Scientists have monitored huge dust storms swirling on Mars. Evidence of erosion indicates that Mars once had rain and water runoff as well.

Jupiter has turbulent weather. What we can see of the planet are actually gas bands in the highest clouds of a thick atmosphere of hydrogen and helium. Traces of the other gases produce bright ribbons of color. Jupiter's most familiar feature is a swirling mass of clouds that are higher and cooler than the surrounding ones. Called the Great Red Spot, it is like a vast hurricane and is caused by tremendous winds that develop above the rapidly spinning planet. Winds blow counterclockwise around this disturbance at about 250 mi (402 km) per hour. In comparison, the most destructive hurricanes on Earth rarely generate winds over 180 mi (289 km) an hour. The Red Spot is twice the size of Earth and has been raging for at least 300 years. Our sun has an atmosphere, too, made up of hydrogen.

Earth's atmosphere is made up primarily of nitrogen and oxygen. Carbon dioxide, ozone, and other gases are also present. These gases keep our planet warm and protect us from the direct effects of the sun's radiation. Without this protection, Earth could not sustain life.

Earth's atmosphere has layers: the troposphere, stratosphere, mesosphere, ionosphere, and exosphere. Closest to Earth is the troposphere. Most of the clouds in the sky are found in this layer. Extending up about 10 mi (16 km) above Earth's surface, the troposphere is primarily nitrogen and oxygen but also contains water vapor, carbon dioxide, methane, and nitrous oxide. These help retain heat, some of which is radiated back to warm the surface of the Earth.

Above the troposphere is the stratosphere, which includes the ozone layer. The stratosphere extends from about 10 to 30 mi (16 to 48 km) above the Earth. Ozone molecules, which are concentrated in this layer, absorb ultraviolet radiation from the sun and protect us from its harmful effects—making life as we know it possible. The coldest part of the atmosphere, the

mesosphere, lies 30 to 50 mi (48 to 80 km) above the surface.

Above the mesosphere, in a layer called the ionosphere, things start to heat up. Temperatures there, about 50 to 180 mi (80 to 289 km) above the surface of Earth, can reach up to several thousand degrees. Beyond the ionosphere is the exosphere, which extends to roughly 500 mi (805 km) above the surface of Earth. This is the outermost layer of the atmosphere, the transition zone into space.

## CLIMATE

The normal pattern of weather experienced in a particular area over a long period of time is known as the climate. The climate tells us how hot, cold, or wet it is likely to be in different parts of the world at different times of year. For example, tropical countries have hot climates and the Antarctic has a cold climate. In the mainland UNITED STATES, CANADA, and Europe, the climate is characterized by four seasons: winter (December through February), spring (March through May), summer (June through August) and autumn (September through November). However, it is not the same all over the world. The high plateaus of Central America's Republic of GUATEMALA experience only two seasons: the wet season, from May to October, and the dry season, from November to May.

In the South American nation of CHILE, winter is mild and rainy in the capital, Santiago, with temperatures ranging from 20 degrees F (-6 degrees C) to 50 degrees F (10 degrees C) and begins in June, spanning July and August. Spring is September through November, followed by summer in December, January and February. Autumn leaves fall in March, April, and May.

The island of Molokai in the Hawaiian chain experiences only two annual seasons. *Kau* is the fruitful season from May through September, when the sun is directly or almost directly overhead, the weather is warmer and drier, and the trade winds are constant. *Hooilo* is the season from October through April when the sun is in the south, the weather is cooler, and the trade winds are often interrupted by other winds.

The African country of UGANDA experiences four annual seasons, the first dry season, followed by the rainy season, then the second dry season, and the humid season. Seasonally, daily temperatures average within several degrees. The average high temperature is 80 degrees F (25 degrees C) from June to September, rising only to a daily average of 85 degrees F (27 degrees C) during the months of January and February.

Uganda's first annual dry period lasts from January through February. The second dry season is from June through September.

However, even in the dry seasons, afternoon rain is common. During the rainy season, from March to May, the country's mostly dirt roads are impassable because of long periods of constant rain lasting for days. The fourth, humid season, during October and November, is sultry and hot.

## THE SCIENCE OF WEATHER FORECASTING

Weather experts today use computer technology and data from stations and satellites all over the world to attempt to predict weather. By carefully monitoring conditions it is possible to forecast what will occur. However, conditions can change abruptly and without warning, frustrating even the most well-trained meteorologist. Computers have greatly improved the accuracy of such forecasting.

In 1904, the Norwegian hydrodynamist Vilhelm Bjerknes suggested that the weather could be accurately predicted by applying a set of hydrodynamic and thermodynamic equations to carefully analyze atmospheric states. However, 44 years passed before two technological developments made mathematical weather forecasting as suggested by Bjerknes possible. The first development was the establishment of a network of weather stations that measured upper-air conditions. The second was the arrival of the first electronic computers.

In 1948, a young meteorological theoretician, Jule Charney, succeeded in deriving simplified mathematical models of the atmosphere's motions, based on Bjerknes' work. The results were dramatic: air flow patterns over North America were accurately forecast 24 hours in advance with greater skill than ever before. With today's increasing number of satellites providing observations from the upper atmosphere as well as computers' increased computing power and speed, such forecasting has improved dramatically.

But it is not just scientists who predict the weather. Farmers and sailors have been doing it for years. As well as looking at the skies, they base their predictions on the behavior of animals, birds, and plants, watching for clues about what will happen next. One of the most reliable of all natural weather indicators are pinecones. These have traditionally been used to forecast the weather, because they change shape according to whether it is wet or dry. In dry weather, pinecones open out as the scales shrivel up and stand out stiffly. When it is damp, they absorb moisture, and as the scales be-

come flexible again, the cone returns to its normal shape. There are a number of flowers that indicate what the weather will be like. The scarlet pimpernel's flowers open in sunny weather but close tightly when rain is expected. The petals of the morning glory act in a similar way—with wide-open blooms indicating fine weather and shut petals predicting rain and bad weather. This opening and closing also occurs with the South African magic carpet flower. In coastal areas, seaweed is often used as a natural weather forecaster. Kelp shrivels and feels dry in fine weather but swells and becomes damp if rain is in the air.

Animals are also frequently observed in age-old weather predictions. It is said that when cows lie down in a field, rain is on its way. This is explained by the fact that cows sense the moisture in the air and are making sure they have somewhere dry to lie down. Squirrels are often used to forecast the weather over the coming winter. If their tails are very bushy or they collect big stores of nuts in autumn, then a severe winter should be expected. Although little scientific evidence has been found to support this, weather forecasting is not always completely science-based.

Meteorologists in training, taught to rely on their own real-world observations as much as computers, are also told the story of a retired TV weatherman whose neighbors believed he could forecast the weather. What he didn't tell them was that he just repeated what he heard on the local TV broadcasts. One autumn, his neighbors asked him whether it would be a cold or mild winter. Having no idea, he said it would likely be cold and that everyone should stock up plenty of firewood. A few days later, he called up his successor at the TV station and asked what the winter would bring. "It is going to be a cold winter," said the new meteorologist. So the retired broadcaster told his neighbors that, indeed, a cold winter was coming. With renewed vigor, they chopped or bought more firewood. A few days later, the retiree was watching the TV weather report and was startled when the meteorologist warned that there were increasing signs that a very harsh winter was ahead. So he passed the word along to his neighbors, who took his warning very seriously and began gathering even more firewood and stacking large stocks in their back yards in anticipation of heavy snows and difficult driving conditions.

A few days later, the retired weatherman decided to call his replacement at the TV station and ask why he believed a harsh winter was in the making. "Oh," explained the meteorologist, "just look around you. People all over town are hoarding firewood like crazy."

## DO TRADITIONAL METHODS WORK?

The weather can affect the way we feel. When damp, cold weather is expected, some people experience aches and pains. Others say they can feel the onset of thunder. Household pets sometimes seem to sense storms before we are aware of them. Is there any scientific basis to substantiate the dependability of folklore? The old saying, "Evening red and morning grey, two sure signs of one fine day" is, believe it or not, quite dependable. Weather tends to move from west to east. A red sky in the evening often means the setting sun in the western sky is shining on clouds in the eastern part of the sky. Precipitation in the east will often move away since weather tends to move east. A gray morning sky as the sun rises in the east means the precipitation is already to the east of the area and will thus not move into the area. However, these signs are not foolproof. Storms do not always move west to east. Also, clouds are not always associated with approaching or exiting storm systems.

"A ring around the sun or moon means rain or snow coming soon" actually is accurate in cooler times of the year, when storm systems and fronts are more common. It is also applicable to tropical storms and hurricanes since there are thin, high clouds around the periphery of the storm system. As an upper-level air disturbance or a warm front approaches, the first clouds to arrive are high in the sky. The ring around the sun or moon is caused by ice crystals within such clouds. The refraction causes light to shine into a ring. However, this method is not foolproof, since wispy cirrus clouds not associated with a storm system will produce a ring as well.

One of the oldest sources of weather prediction in the United States is the *Old Farmer's Almanac*, an annual publication filled with advice for the self-sufficient. The *Almanac* claims an 80 percent success rate in forecasting the weather—18 months ahead. How? "For years, readers have asked us how the *Almanac* does it," wrote spokesperson Janice Stillman in an editorial note: "First, we don't divine the weather by counting onion layers, measuring woolly-bear bands, or tabulating the acorns that squirrels sock away—although such phenomena may well be indicators of upcoming weather. Neither do we guess."

Instead, she wrote, the *Almanac's* methodology is scientific, state of the art, and based on a secret formula devised by *Almanac* founder Robert B. Thomas around 1792. That formula is "locked in a black box here in Dublin, New Hampshire, and shall not be divulged in my lifetime," wrote Stillman. Thomas be-





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|---|--|
| 1 Mt. Wai-'ale-'ale, Kauai, Hawaii: up to 360 rainy days annually               | 12 Dallol, Ethiopia, annual mean temperature 94°F (34.4°C)                         |
| 2 Death Valley, Cal., over 120°F (48.9°C) on 43 consecutive days (1917)         | 13 Agata, USSR, barometric pressure high of 1083.8 mb (Dec. 31, 1968)              |
| 3 Wichita Falls, Tex., 280 mph (450 kph) tornado (Apr. 2, 1958)                 | 14 Verkhoyansk, USSR, 192°F (106.7°C) extreme temperature range                    |
| 4 Silver Lake, Col., 76 in (1930 mm) snowfall in 24 hours (Apr. 14–15, 1921)    | 15 Cherrapunji, India, 1041.78 in (26,461 mm) rain in one year (1861)              |
| 5 Mt. Rainier, Wash., 102 ft (31 m) snowfall in one year (Feb 1971–Feb. 1972)   | 16 Gopalganj, Bangladesh, 2 $\frac{1}{4}$ lb (1.02 kg) hailstones (Apr. 14,, 1986) |
| 6 Browning, Mont., 100°F (56°C) temperature range in one day (Jan. 23–24, 1916) | 17 Near Guam, barometric pressure low of 870 mb (Oct. 12, 1979)                    |
| 7 Mt. Washington, NH, 231 mph (371 kph) wind speed (Apr. 12, 1934)              | 18 Saipan, Mariana Islands, only 21.2°F (11.8°C) extreme temperature range         |
| 8 Grand Banks, Newfoundland, more than 120 foggy days a year                    | 19 Tutunendo, Colombia, annual average rainfall 463.4 in (11,770 mm)               |
| 9 North Pole, 186 days a year without sunshine                                  | 20 Atacama Desert, Chile, annual mean rainfall nil                                 |
| 10 Cal'Azizyah, Libya, 136.4°F (58°C) (Sept. 13, 1922)                          | 21 Pole of Cold, Antarctica, annual mean temperature -72°F (-57.8°C)               |
| 11 Eastern Sahara, more than 4300 hours sunshine each year                      | 22 Vostok, Antarctica, -128.6°F (-89.2°C) (July 21, 1983)                          |
|   | 23 Commonwealth Bay, Antarctica, 200 mph (320 kph) gales                           |

*As the above map of weather extremes illustrates, weather is constantly changing, and there remains a high degree of uncertainty in all weather predicting. Each weather system requires a slightly and sometimes drastically different approach.*

lieved that solar magnetic storms influence Earth weather. “He didn’t originate the idea,” she wrote, “it evolved after Galileo first noted sunspots in 1610.” She went on to assert that the notion that solar events

could affect our weather might have been dismissed by the meteorological and academic community for years, but “more recently, the idea has been receiving serious consideration.”

## THE TROPOSPHERE

All the Earth's weather takes place in the lowest part of the atmosphere, the troposphere, which is affected strongly by the sun. It is the troposphere that contains most of our atmosphere's water vapor. Without water there would be no clouds, rain, snow, or other weather features. The air in the troposphere is constantly moving. As a result, aircraft flying through this layer can give passengers a very bumpy ride—as planes are bounced around by what airline pilots casually warn the passengers will be “a bit of turbulence up ahead.” Because of this turbulence, most jet airlines fly in the stratosphere. There, up above the clouds, the air is clear and much more still.

The various layers of our atmosphere press down on the Earth's surface, exerting a force called atmospheric pressure or air pressure. This varies constantly based on the temperature of the air. Cool air is denser and heavier than warm air. Cool air will sink. Warm air is lighter than cool air and will rise. All air has weight, regardless of its temperature. One reason is that the air is filled with varying degrees of water vapor. If you live in the United States, there are 40 trillion gallons (151 trillion liters) of water above your head on an average day.

Each day, about 4 trillion gallons (15 trillion liters) of this water fall to Earth as precipitation, such as rain, snow or hail. Some of the water that falls to Earth soaks into the ground and provides runoff to rivers, lakes, and oceans. The remainder—more than 2.5 trillion gallons (9.4 trillion liters)—returns to the atmosphere through evaporation, and the process begins again.

Of the 326 million cubic mi (525 million cubic km) of water on our planet, 3,100 cubic mi (4,991 cubic km) are found in the atmosphere. As water evaporates from the oceans, it enters the atmosphere and collects on small particles in the air as droplets or ice (a process called condensation) and forms clouds. When enough water or ice collects in a cloud, it rains. If the temperature is low enough, it snows. There are many kinds of clouds. Each signals a different kind of weather. Cirrus clouds, for example, are high up in the troposphere. Winds in the upper troposphere make these clouds look wispy and thin. Though they are composed of ice, they are usually associated with pleasant weather. Stratus clouds, which form in lower parts of the troposphere, consist of water droplets and cover most of the sky with an even, gray color similar to a fog. These clouds (as well as some cumulus, nimbostratus, and other cloud types) can signal light rain. Cumulonimbus

clouds are tall, dense clouds shaped like a block or anvil. They signal thunderstorms and also spawn tornadoes, as well as other violent weather effects such as hail and lightning.

The continuous process of precipitation and evaporation is called the water cycle, or hydrologic cycle. It's been going on ever since oceans were formed on this planet. In the atmosphere, rivers, oceans, groundwater, and elsewhere on Earth there are an estimated 525 cubic km (326 million cubic mi) of water. Less than 1 percent of that water is present in rivers, lakes, and groundwater: we use these sources for our drinking water. Most of it, 97 percent, is in the oceans. The oceans distribute heat around the planet, keeping heat and cold circulating by way of surface currents.

Air currents occur when areas of high pressure are created. That happens when cool air sinks and presses on the ground. In areas experiencing high pressure, the weather is usually dry and clear. In contrast, when warm air rises, it causes an area of low pressure. In areas of low pressure, the weather is often wet and cloudy. When air rises or sinks, another result is wind. Air moves from areas of high pressure to areas of low pressure, and this produces currents as the atmosphere flows from one area to another—wind.

Each day's conditions are influenced by these high and low pressure zones, caused by air temperature. The temperatures are caused by the area's position on this planet and the angle at which the sun's rays hit. It is the sunlight that heats the air, causing the high and low pressure conditions and the resulting air flow as the atmosphere's gases rise and sink.

The angle at which the sun hits each location on Earth changes because the Earth is tilted at an angle on its axis. As the Earth moves around the sun during the year, different parts of the Earth are tilted towards the sun at different times. In the Northern Hemisphere, when the North Pole tilts away from the sun, the sun is low in the sky and days are short, bringing winter. When the North Pole tilts toward the sun though, more light and heat reaches the Northern Hemisphere. The sun is high in the sky and days are long. This change brings summer.

Two main features combine to create most of our daily weather changes: the sun and moisture in the air. Together, these two are responsible for clouds, rain, thunderstorms, and winds. Without the sun there would be no weather. Sunlight is the energy that powers the world's weather systems.

By warming the air above the Earth, the atmosphere is kept in constant motion, creating weather fea-

tures such as wind, rain, snow, hail and thunder, as well as sunshine itself.

### EXPERT PROGNOSTICATIONS

Today, powerful computer systems used by the U.S. National Weather Service combine data from radar, satellite images, computer models, high-tech weather balloons, and hourly observations from virtually every airport in the country, as well as measurements taken by commercial jets as they fly about. The computer then puts all this data in the hands of forecasters. That data is combined with old-fashioned human ingenuity and occasional gut instinct to make predictions. But the reality is that today's forecasts, while more accurate than ever, can dazzle with precision one day, then be totally off the mark the next.

Despite science's advancements in storm prediction, errors still occur. It is said that little can be certain about the weather. Actually one thing is certain: Weather is constantly changing and there remains a high degree of uncertainty in all weather predicting. Each weather system requires a slightly and sometimes drastically different approach.

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## West Virginia

WITH ITS CAPITAL at Charleston, West Virginia occupies 24,181 square mi (62,629 square km). Its lowest point is the Potomac River at 210 ft (73m) near Harper's Ferry. It's highest point is Spruce Knob at

4,863 ft (1,483 m) and its primary natural resources are coal, natural gas, stone, salt, oil, and mineral springs.

West Virginia (population 1,808,344) is known as the Mountain State for obvious reasons: unless you are traveling along a river valley, you are always traveling either up or down. Two major physical regions dominate the state: the Appalachian Ridge and Valley Region in the east and the Allegheny Plateau in the center and west. West Virginia's borders are defined almost entirely by natural features—rivers and ridges—giving it one of the most irregular shapes of any state in the United States.

Formerly known as the Trans-Allegheny region of VIRGINIA, the new state of West Virginia was created in 1863 out of the northwestern counties of Virginia, both for reasons of both politics (prounion, antislavery), and of economics. Much of the population of western Virginia was oriented toward the development of the Ohio River valley and the wild west beyond, not toward the tobacco plantations of Virginia's Piedmont and Tidewater areas. The new state needed access to eastern commercial and port cities, however, so the counties now known as the Eastern Panhandle were added, providing an economic supply line via the Baltimore and Ohio Railroad. Through the succeeding century, West Virginia supplied the nation with much of its raw coal. This has been less in demand since the 1960s, seriously weakening the local economy, which had become almost entirely dependent on coal mining.

The Appalachian Ridge and Valley Region consists of several parallel ranges and narrow valleys. Only the easternmost ridge (in the Eastern Panhandle) is the Blue Ridge, whereas the rest are the Allegheny Mountains. Most of the rivers in this area are small and swift and flow northward into the watershed of the Potomac River, which forms the state's northern boundary with MARYLAND. A few of the rivers in this region flow south and east into the James River valley of Virginia. West Virginia's highest peaks are located in this region, including Spruce Knob.

Many of the mountains in West Virginia rise above 4,000 ft (1,200 m), with the average elevation of the entire state at 1,500 ft (450 m). The peaks of the Ridge and Valley Region are heavily forested and lie within some of the nation's largest protected forests, the Monongahela and the George Washington national forests. The western edge of this region is called the Allegheny Front, where the sharp, rugged mountains of the east meet the more rolling terrain of the Appalachian Plateau. The Allegheny Front runs in a

southwest-to-northeast line, roughly from Keyser to Bluefield.

The Allegheny (or Appalachian) Plateau, which covers five-sixths of the state, was once relatively level but has been cut down through erosion over millions of years, creating flat-topped highlands and several deep and windy river gorges, most notably the New River (ironically one of the oldest rivers in the nation). Rivers in this region flow westward to the Ohio River: the New joins with the Kanawha to form the state's most important waterway.

Other rivers in this region include the Big Sandy River, the Cheat, and the Monongahela (which flows northward, passing through Pittsburgh, before finding its way back to the Ohio Valley). These river valleys are the site of most of West Virginia's industries and largest towns: Charleston, Huntington, Parkersburg, and Wheeling. Wheeling is the main town of West Virginia's second irregular promontory, the Northern Panhandle, a thin wedge that follows the Ohio River between the states of OHIO and PENNSYLVANIA (at its narrowest, only 15 mi or 24 km wide).

West Virginia's borders with PENNSYLVANIA are the only part of its borders that do not follow natural contours, but instead were marked along straight lines set down by surveyors in the 18th century, including the westernmost 56 mi (90 km) of the Mason-Dixon line. A leading industrial city and shipment point, Wheeling was the state capital from 1863 to 1870, and again from 1875 to 1885.

There are 55 counties in West Virginia. The population is relatively mixed, with predominantly African-American counties concentrated in the far south, while the Appalachian Highlands were first settled by Scots-Irish, reminded of the rolling blue-green mountains of the Scottish Highlands. Charleston and other large towns saw rising levels of European immigrants in the early part of the 20th century, notably Italians, Poles, and Hungarians.

Charleston today has a population of roughly 52,000 (2002) and is the center of West Virginia's heavy industries (along the Kanawha River as far downstream as the Ohio Valley) and emerging high-technology industry. Tourism is replacing coal as West Virginia's most important economic activity: visitors are drawn to the magnificent mountain scenery and associated activities: hiking, camping, white-water rafting (along the New River in particular), some of the most famous rock-climbing faces in the eastern United States (like Seneca Rocks), and West Virginia's numerous mineral springs, such as those at the resort towns

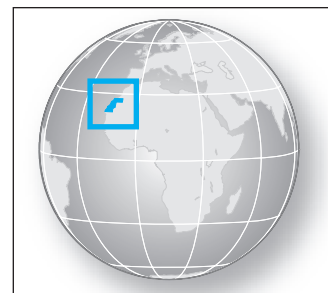
of Berkeley Springs and White Sulphur Springs. Remains of Native American settlements are found predominantly in the Northern Panhandle, including the famous conical burial mounds at Moundsville.

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## Western Sahara

**Map Page** 1113 **Area** 102,703 square mi (266,000 square km) **Population** 261,794 **Capital** None; occupied by Morocco **Highest Point** 2,700 ft (823 m) **Lowest Point** -180 ft (-55 m) **GDP per capita** na **Primary Natural Resources** phosphate.



AS OF 2005, WESTERN SAHARA, formerly called Spanish Sahara, was officially occupied by MOROCCO. Western Sahara is one of the most inhospitable places on earth. On average, it has only 2 in (5 cm) of rain a year. It is almost entirely a land of hot, dry, sandy and rocky desert with sparse vegetation. Western Sahara is about the size of Great Britain or COLORADO. It shares a border of 276 mi (444 km) with Morocco in the north, 19 mi (31 km) with ALGERIA in the northeast, and 976 mi (1,571 km) with MAURITANIA in the east and south. Western Sahara is the extreme western end of the SAHARA DESERT on the ATLANTIC OCEAN. The coastline is 660 mi (1,602 km) long. Much of the coastline is a wall of sheer cliffs. There are only a few natural harbors, while sand banks and shallow coastal waters make the coast dangerous. Along much of the coast is a narrow belt of sand dunes about 10 to 20 mi (16.1 to 32.2 km) wide. Most of the remainder of the country is windswept gravel plains.

Western Sahara has two major regions. In the north is the Saguia El-Hamra region. It begins at the border with Morocco and extends south to an east-



west line from Boujdour on the coast to the northern border with Mauritania. The Saguia El-Hamra region is named after the Seguia El-Hamra (the “Red River”) river valley. It is the only important river in the country, but its flow is mostly seasonal during the wet season. It flows east to west from its source in the Zemmour massif across the northern part of the country. What little water it carries flows into the Atlantic Ocean. There are several other rivers in Western Sahara, but all are seasonal with water only during the wet winter-time. In the Saugia El-Hamra region, the land rises gradually from the coastal sand dune belt to the east. It reaches its maximum height of around 1,300 ft (396 m) in the El-Gaada area in the northwest of the country. In the extreme northeast, the hammada is part of a gravel plain that extends deep into Algeria.

Western Sahara’s southern region is the Rio de Oro. It occupies the southern two thirds of the country. The northern half of the Rio de Oro region is also the middle third of Western Sahara. It is flat desert from the coastal sand dunes until it meets the Zemmour massif in the east where it borders Mauritania. The Zemmour massif rises to 2,700 ft (823 m). The southern third of the Western Sahara, which is also the southern half of the Rio de Oro region, contains the plain of Tiris. In the extreme northeast of the southern third of the Rio de Oro is the Rio de Oro Bay where the port of Dakhia (Villa Cisneros) is located. The coastal area south of Rio de Oro Bay is called the Aguerguer el Aatf. In the extreme south-central region of the Rio de Oro is the mountainous Adrar Soutouf, which has peaks of about 1,700 ft (518 m).

Western Sahara has desert winds. The worst is called the *irifi*, which is a sandstorm that blows out of Atlantic from the southeast. There are no significant oases in the Western Sahara. Most of the vegetation is shrubs or the occasional acacia tree. Most of the significant vegetation is in the Saguia el-Hamra and its tributaries. There are some rocky cisterns (*guelta*) where winter rainwater gathers.

The population of Western Sahara is small and largely nomadic. Most people are Arabs or Berbers; there are also a few Spaniards and Africans. The native people are Tauregs, Reguibat, Delim and the Izarguen. The people are today collectively called Saharawis.

The two most important cities are Laayoune (formerly El Aioun) located in the Sekia el Hamra zone, and Dakhla (formerly Villa Cisneros), on the Rio de Oro peninsula on the Atlantic coast.

After the discovery of rich phosphate and iron deposits in the 1960s, Morocco and Mauritania pressed

historic claims to the area. However, native Saharawis organized a war of liberation to counter these claims. Calling themselves the Popular Front for the Liberation of the Sekia el Hamra and Rio de Oro or “Polisario,” they forced Mauritania to withdraw. Morocco currently administers the country, but the Polisario controls most of it.

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## wetlands

**WETLANDS ARE WATER-BASED** ecosystems that cover approximately 6 percent of the Earth’s land area, an estimated 3.3 million square mi (8.6 million square km). Wetlands occur on every continent except ANTARCTICA and in every climatic zone from the humid tropics to DESERT to tundra. Three climatic zones of the world (tropical, subtropical, and boreal) support 70 percent of the world’s wetlands. Together, tropical and subtropical zones have an estimated wetland area of 1.3 million square mi (3.4 million square km); the boreal zone has an estimated 1 million square mi (2.6 million square km) of wetlands.

Wetlands include many familiar ecosystems, such as swamps, bogs, fens, mires, and moors, which have different names in various regions of the world. As wetlands often occur at the interface between dry terrestrial ecosystems and permanently saturated aquatic ecosystems (rivers, lakes, estuaries, and oceans) they are sometimes considered to be ecotones, transition areas or interfaces between ecosystems.



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Wetlands are not always easily defined or identified. Moreover, wetland definitions are numerous and sometimes contradictory: over 50 different definitions of wetlands are used worldwide. In 1979, wetland scientists in the UNITED STATES developed a comprehensive definition of wetlands based on three criteria: vegetation, soils, and hydrology—the delivery and retention of water in the ecosystem. Wetland hydrology is typified by the presence of water at or near the ground surface for at least part of the year. The amount, timing, and duration of water supply are important in defining wetlands. For example, a wetland may be permanent—having standing water or saturated soil horizons across the year or seasonal with water present for a portion of the year. Plants typical of wetlands are hydrophytes (plants adapted to wet conditions) that grow wholly or partially in water.

Oxygen is often limited in the saturated soils of wetlands and hydrophytes cope with root anoxia by having structural and physiological adaptations to enhance oxygen delivery to tissues. Dominance of vegetation by hydrophytes is a good wetland indicator even if

standing water is absent, as it may be in seasonal wetlands. Hydric soils, those that develop under saturated, low-oxygen or anaerobic conditions, dominate wetlands. Redoximorphic features (physical attributes that develop under anaerobic conditions) are typical of hydric soils and include gray layers, mottles and oxidized rhizospheres (rooting zone of the soil horizon). Gray layers and mottles are formed when iron compounds are reduced by bacteria under anaerobic conditions; oxidized rhizospheres are thin traces of oxidized iron formed from excess oxygen diffusing from plant roots.

There are many types of wetlands worldwide and numerous efforts have been made to categorize and classify them in a useful manner. The U.S. Fish and Wildlife Service has developed a hierarchical classification for wetlands that identifies four major systems—a complex of wetlands and deepwater habitats with shared hydrologic, geomorphic, chemical, and biological traits having many subsystems and classes.

The four major wetland systems are estuarine, riverine, palustrine, and lacustrine. Estuarine wetlands are coastal wetlands, like salt marshes and mangrove

forests, influenced by tides and fluctuating salinity from the mixing of saline ocean waters and freshwater river flows and runoff. Riverine wetlands are freshwater wetlands associated with river and stream channels. Riverine wetlands may be tidal, with fluctuating water levels; perennial, non-tidal with continuous water flow; or intermittent, having no flow for part of the year. Riverine wetlands are sometimes also called riparian wetlands when they occur in a stream or river FLOODPLAIN.

Palustrine wetlands are inland freshwater wetlands that are not associated with a stream channel but may be bounded by uplands or associated with lakes less than 20 acres (8 hectares) in size. Palustrine wetlands are among the most common worldwide and include marshes and forested wetlands such as swamps and pocosins. Lacustrine wetlands are freshwater wetlands associated with lakes greater than 20 acres (8 hectares) in size. Lacustrine wetlands are commonly associated with the near-shore of lakes, the LITTORAL zone, and are dominated by emergent plants like cattail that are rooted below water but have upright stems that rise above the water surface.

### SIMPLE CLASSIFICATION

Some experts consider a hierarchical, system-based wetland classification too complicated for everyday use and instead rely on a system based on the growth form of dominant wetland plants: grasses and herbs, shrubs or trees. Marshes are wetlands dominated by non-woody plants like graminoids, grasses and grasslike plants such as sedges and rushes. Shrub wetlands are dominated by low-growing multi-stemmed woody plants, shrubs like azalea or blueberry. Forested wetlands, swamps, are dominated by trees.

A second simple classification system focuses on soil type and identifies wetlands as either mineral or organic soil wetlands. Mineral soil wetlands include swamps, marshes, PLAYAS (marshlike ponds in the southwestern United States), potholes (marshlike ponds in the Dakotas and Canadian prairie provinces), wet meadows, and wet prairies, among others. Organic soil wetlands include bogs, fens, mires, moors, and muskegs (boglike wetlands of CANADA and ALASKA), inclusively known as peatlands because of substantial accumulation of peat (dead plant matter) in the soil. Bogs and fens are common organic soil wetlands in cool climates. They differ in hydrology, nutrient content, pH, and peat sources.

Wetland area has declined considerably in most regions of the world owing to alteration, especially hy-

drologic alteration, and destruction by humans. Some estimates put worldwide wetland loss at 50 percent, with some countries loss of wetland area exceeding 80 percent.

Wetlands were historically viewed as wastelands, malodorous swamps spewing miasmas that bred malaria and other infectious diseases. In North America and Europe, wetlands were extensively drained for agriculture, with drainage often promoted by the government. For example, the Swamp Lands Acts of 1849 and 1850 in the United States transferred 59 million acres (24 million hectares) of wetlands to the states, which sold them to private citizens to promote drainage and agriculture. Of the estimated 3.4 million square mi (8.9 million square km) of wetlands in the United States in 1780, over 50 percent had been lost by the early 2000s.

Efforts to identify and quantify the ecological value of wetlands have helped raise awareness of wetland loss and degradation and have fueled conservation and restoration initiatives and protective legislation at local, regional, national, and international levels. For example, the Convention on Wetlands of International Importance—the Ramsar Convention, adopted in Iran in 1971—provides a global framework for protection of wetlands for migratory species, especially birds, and human populations dependent on wetlands.

The value of wetlands as natural nurseries for wildlife, fish and shellfish for commercial harvest, recreation, and aesthetics and their role in flood moderation, water quality improvement, and as sources and sinks in global material cycles are unparalleled.

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## wine geography

FROM THE TIME THAT the seafaring Phoenicians introduced wine to Egypt—and wealthy Egyptians grew grapes in a warm but otherwise imperfect climate 4,500 years ago—several geographic rules have guided the trade. First, it was never difficult to cultivate a taste for wine. If far-flung commerce proved impossible at certain times and places, the product could be sustained by a few advocates and the local population. The growth of an industry, however, came by one of two routes: either happening at the right locale or overcoming agricultural (and maybe perceptual) barriers through persistent scientific methods.

Europe's leading producers—FRANCE, ITALY, SPAIN, GERMANY, and PORTUGAL—have been “in practice” for the better part of 2,000 years, originally replacing Roman state-of-the-art with a more indigenous craft. Grape growing and wine making occurred together in small, tightly bound locales, usually individual estates, monasteries, or villages. (Rough transportation and the fruit's delicate nature would not permit much of a physical separation between the two activities.) The ravages of disease, war, and changing boundaries tested production, with growing mercantilism at times diluting, then demanding, integrity. When their supply of wine could not keep pace with consumption during the 18th century, Portuguese merchants simulated its taste and expanded its bulk by using a variety of natural additives, not necessarily in the local tradition. The crown subsequently instituted regulations in order to retain the large, influential English market. With renewed attention to local grapes, the first formal wine region, Douro, came into being.

A regional rating system was conceived for the Universal Exposition in Paris (1855), when Bordeaux chateaux (estates) were ranked along a five-tiered system of *crus* (growths). These commercially driven designations later extended to other locales, ultimately coexisting with official French labeling requirements and ratings.

European governments initiated formal quality control measures starting in the 1930s, as part of the economic recovery plan following agricultural disasters and World War I. Two intertwined concepts developed. The French notion of *terroir* (reflected in the *cru* designations) implied an almost magical blend of traditional artisanship and local climatological/geographic features.

Elements such as sunlight, soil composition, drainage, and temperature were naturally observed

and felt, but not scientifically dissected. Terroir became a besotted concept of place, internalized by most of Europe. A regulatory side emerged, too: winegrowing countries designated controlled appellations, regions with both growing and bottling methods tightly prescribed. Rating systems often validate such exemplary products.

Typology was generally overlooked in European viticultural parlance, however. Different regions have long cultivated several types of grapes, simultaneously. Blending was standard practice when done locally, but this alchemy largely eluded codification.

With vines exported to remote colonies, however, the question became: which varieties (and, subsequently, varietal wines) would survive where? European grapes flourished in some parts of AUSTRALIA, SOUTH AFRICA, and the Americas, yet even the CALIFORNIA wine industry, blessed with diverse and excellent growing conditions, boomed only when railroad transport afforded access to the more densely populated eastern U.S. market.

For countries off the major trade routes, viticulture was kept alive primarily by local/national consumption. South American malbecs and cabernets, descended from European varieties but nurtured regionally since the mid-1800s, have finally burst into a contemporary world market that is at once increasingly daring and demanding. And it may be difficult to fathom that companies like Penfolds and Lindemans, associated with the “new” Australian wine industry, have existed continuously for over 150 years.

Varieties that adapted readily to California and New Mexico were of the wine-friendly European *Vitis vinifera*. Indigenous (or wild) East Coast grapes named concord and catawba came from different species altogether, mostly *Vitis labrusca*. As a rule, their products did not excite consumers.

Explorers and merchants had been exchanging agricultural exotica since ancient times, but purposeful cross-polonization was largely unpracticed. The situation changed when the phylloxera louse, unwittingly imported from the eastern United States to Europe, rapidly destroyed vast acres of heirloom vines. Long immersion in infested soil rendered native American varieties immune to this plague. Ultimately, and despite trepidation, European vintners grafted their vines onto American rootstock.

While downplayed in the Old World, this rescue effort compelled agronomists in the eastern United States to once more attempt growing European varieties. The pioneering New York State Agricultural Experiment



Station in Geneva fostered productive experimentation as early as the 1890s.

The scientifically based concept of MICROCLIMATE evolved from studies at the University of California, Davis, beginning in the 1930s and progressing a-sunder over the next 40 years. Like *terroir* in its geographic underpinnings, microclimate started with temperature and eventually yielded a more sublime climatological analysis, including local topography, fog, and hours of sunlight. The quest was to determine which varieties would grow best under definable conditions. This structured framework encouraged enthusiasts to expand viticultural boundaries; wines currently are produced in 48 of the 50 United States.

To consumers overseas merely 35 years ago, the Napa Valley was synonymous with quality American wine, and almost monolithic in its status. Today, microclimate applications bring a more exact definition to the European concept of *terroir*: the Napa Valley now is jigsaw puzzle of 15 American Viticultural Areas (AVAs). In fact, one can find hundreds of AVAs throughout the nation. Products within these areas must adhere to certain standards (such as percentages of regionally grown grapes in the wine), with districts “recognized,” but not drawn, by the U.S. Bureau of Alcohol, Tobacco and Firearms.

The trend toward regionalization confronts a rival philosophy. As writer Stett Holbrook notes, American winemakers (and Australians, too) may be divided into two camps: “terroirists” and “counter-terroirists.” The latter have taken blending out of the closet and transformed it into art: several varieties may happily wed in a classical style, yielding meritage wines; the same type of grapes, from different regions, can be blended into superb and/or affordable varietals; or producers can strive for a taste type that consistently appeals to consumers and establishes brand loyalty.

If one can make (imperfect) generalizations between Old World and New World wines these days, it lies in the presence, or absence, of formal qualitative ratings. But even European traditions are changing. Precise geographic information (descending from region to village to vineyard, and all appearing on the label) once marked a distinctive wine. Yet some producers now squeeze varietal names, in larger letters, onto that same crowded micropage. During the 1990s, Italy added a fourth category to its *denominazione di origine controllata* system: *indicazione geografica tipica* (typical geographic indication), which does not abandon regional identity but places greater emphasis on the variety or varieties contained in the bottle.



*The Napa Valley in California proved fertile for wine grapes, which today are among the best in the world.*

Bringing another dimension to European labeling, French and German regional cooperatives can advertise their geographic affiliations while offering certain economies of scale to the consumer. Indeed, a consistent commercial challenge has been to close the DISTANCE between producer and market. Distance could be interpreted literally for most of history; now it is an information issue: recalling the adventures of footloose palates—even one’s own—and allowing them to guide future explorations.

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## Winnipeg, Lake

LOCATED IN THE SOUTHEAST portion of the Canadian province of Manitoba, Lake Winnipeg (Cree for “murky or muddy waters”) is 266 mi (428 km) long and has an area of 9,417 square mi (24,390 square km). English explorer Henry Kelsey was the first European to visit the area in 1690 and is believed to have given the lake its name. The lake has an average depth of 50 ft (14 m), is 713 ft (217 m) at its deepest point, and is located 711 ft (216 m) above sea level. The lake generally is frozen over from November through March.

The lake is part of the huge Nelson River drainage basin, which extends from the Canadian Rockies in western CANADA to near lake SUPERIOR in southwestern Ontario. The lake’s watershed measures about 380,001 square mi (984,200 square km). The two largest suppliers of water to the lake are the Winnipeg and Saskatchewan rivers, accounting for 75 percent of the inflow. Other rivers such as the Red, Dauphin, and Berens, make up the remaining 25 percent. The lake itself is drained by the Nelson River, which flows from the northeast part of the lake to Hudson Bay. Spring and summer account for the largest inflow periods for the lake because of the melting of mountain snows and the area’s generally wetter springs.

Lake Winnipeg, the 13th-largest lake in the world and the 11th largest freshwater lake, is located in an area known as the Lake Agassiz Basin, which is a remnant of Lake Agassiz, a prehistoric glacial lake. A number of islands are found within the lake including, Hecla, Reindeer, Berens, and Black, which form part of Hecla Provincial Park.

The lake is an important part of the Lake Winnipeg Regulation Project, which is part of Manitoba Hydro’s hydroelectric projects on the Nelson River. Manitoba Hydro is in charge of regulating the flow of the lake into the Nelson River, and Lake Winnipeg is used as a natural reservoir for hydroelectric development on the Nelson River.

The main need for regulating the flow of the lake is due to the fact that the natural flow is opposite to the energy needs in the province. More electricity is consumed in winter than in summer, while the water flow into the Nelson River from Lake Winnipeg is naturally the opposite. The lake is also an important recreational and tourism destination especially along the southern shore of the lake, which is located only 30 mi (55 km) from the Manitoba province capital of Winnipeg. The fish population is estimated to number nearly 4 mil-

lion; major species include whitefish, perch, walleye, and pike. Fishing on Lake Winnipeg yields an average of \$15 to 20 million per year.

The lake is also home to a large number of birds, including the endangered piping plover, American white pelican, and bald eagle. Lake Winnipeg marks the western edge of the East-Side Forest, which is a vast boreal wilderness and is considered one of Canada’s most significant frontier forests.

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## Wisconsin

Wisconsin lies on the western border of Lake MICHIGAN. Covering some 65,503 square mi (169,652 square km), the state ranks 23rd overall in size. With nearly half of the state’s 5,363,675 population (2000) living in five major urban areas, the state has a comfortable country feeling with approximately 44 people per square mi (114 per square km).

Madison, the state capitol, is also the second largest city (426,526 population) behind Milwaukee (1,689,572). Wisconsin is bordered by MINNESOTA and MICHIGAN on the north including a short section of Lake SUPERIOR, and by ILLINOIS on the south. To the west, Minnesota and IOWA border Wisconsin. The state is typically divided into five geographical land areas: the Lake Superior Lowland; the Eastern Ridges and Lowlands (Great Lakes Plains); the Northern Highland, or Superior Upland; the Central Plain; and the Western Upland.

As a result of glacial movement and settling during and after the last ice age, the state has more than 10,000 lakes of varying size. These range from small mountain lakes to large bodies of water such as Lake Winnebago (215 square mi or 558 square km). Interestingly, the large number of lakes and rivers account for more than 17 percent of the state’s total area (11,190 square mi or 28,982 square km). The Wisconsin River, dividing the state into two distinct sections,

flows generally southward across the state before turning west to empty into the Mississippi River. The rivers on the eastern side of the state, the Menominee, Peshtigo, Wolf, and Fox, flow into Lake Michigan.

Wisconsin's rich landscape of rolling forested hills and scattered lakes makes it a sportsman's dreamland, with abundant opportunities for hunting, fishing, and water sports. There are numerous state parks and several national parks, including the Saint Croix Scenic Rivers and the Apostle Islands National Lakeshore. The average elevation is 1,050 ft (320 m) above sea level, with the highest point at 1,951 ft (595 m) at Timms Hill and the lowest at 581 ft (177 m) at Lake Michigan.

Lumber has been the state's biggest resource from the very beginning. The dense white pine forests in the north and hardwoods throughout the central valleys have been irresponsibly cut in the past, but at one time they covered all but the southern plains of the state. Numerous programs of reforestation and conservation have since saved the beauty of the state and maintained the valuable lumber industry. Today, 40 percent of the state is forested and the paper-products industry in the cities of Green Bay and Appleton is one of the nation's largest.

## STATE INDUSTRY

Most of the state's major industries are located in Milwaukee. Here, the manufacturing of machinery, vehicles, medical equipment, and metal products rivals the meatpacking, brewing and dairy-processing industries whose origins date to the 19th century. Prior to 1965, Wisconsin had a considerable iron-mining industry in the northern parts of the state. Following the demise of iron mining, deposits of copper have been mined in the north as well as sand, gravel, stone, lime and various mineral deposits in the southwest. Wisconsin has numerous ports on the Great Lakes capable of accommodating oceangoing vessels. The harbor at Superior (shared with Duluth, Minnesota) has sizable shipyards and coal and ore docks that are among the largest in the nation.

Wisconsin has an impressive dairy industry, ranking as the nation's second-largest producer of milk, and the largest producer of cheese. Corn, soybeans, potatoes, and oats are also grown in commercial quantities in addition to many other crops. Wisconsin's shipbuilding industry flourished during World War II, and industrial growth and urbanization continued in the postwar era. Tourism and outdoor recreation are also important economic sectors.

Several hundred years ago in the roots of American history, the area of Wisconsin was famous for its fur trading. In 1686, Nicolas Perrot claimed the Green Bay region in its entirety for FRANCE. The movement of settlers in the east was also pushing various Native American tribes, including the Huron and the Ottawa into the Wisconsin area, thus displacing the older native inhabitants, the Winnebago and Kickapoo. After the French and Indian wars of 1763, Wisconsin fell to the British, who controlled the area well after the American Revolution. The British continued to dominate the fur trade in the area until the War of 1812. Definite U.S. control of the Wisconsin territory did not come until the Treaty of Ghent, when the American Fur Company took control of the industry. Ironically, the fur industry was already in a decline by that time. Fortunately, lead mining and a boom in lead prices brought a rush of immigrants who quickly realized the agricultural potential of the southern territory. The local Native Americans were quite resistant to the flood of new Americans, and were quite hostile toward the settlers. The peak of this confrontation resulted in the brutal Black Hawk War, the last serious Native American resistance in the area.

Wisconsin became a territory of the UNITED STATES in 1836 when the capital city of Madison was founded. As the population began to rise, there were several propositions for statehood, but fearing a strict government and high taxes, the people rejected them. Still, the hope lingered that becoming a state would bring prosperity and better communication and it eventually led to Wisconsin statehood (as the 30th state) on May 29, 1848. After rallying with the Union forces during the Civil War, the social and economic growth became rapid. In the 1870s Wisconsin's dairy industry began to take off, as well as the lumber industry that took advantage of the immense pine forests in the northern parts of the state.

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## Wyoming

Wyoming is one of the ROCKY MOUNTAIN states located in the west-central UNITED STATES. Rectangular in shape, it is bordered by MONTANA to the north, SOUTH DAKOTA and NEBRASKA to the east, COLORADO and UTAH to the south and IDAHO to the west.

With an area of 97,818 square mi (253,348 square km), Wyoming ranks 10th nationally in size. With the smallest population of any state (493,782), Wyoming remains a remarkably undeveloped state; cattle outnumber people by almost three to one. Because the western one-third of the state is covered by the Rocky Mountains, the state's average elevation is 6,700 ft (2,043 m), making it the second-highest in the continental United States behind Colorado. The lowest place in elevation is 3,099 ft (945 m) above sea level along the Belle Fourche River in the northeastern part of the state, while the highest point is Gannett Peak at 13,804 ft (4,207 m) in the Wind River Range.

There are four distinct geographic regions in the state: the Great Plains, the Southern Rocky Mountains, the Middle Rocky Mountains, and the Wyoming Basins. The Great Plains region is located mostly in the northeastern part of the state and consists of numerous low hills and isolated buttes. The most notable natural features of the region are the Thunder Basis Grasslands to the west of the Black Hills Region of South Dakota between Gillette, New Castle, and Sundance and the Devils Tower National Monument, a volcanic rock formation on the Belle Fourche River just north of Sundance in the far northeast corner of the state.

The Wyoming landscape becomes mountainous in the Southern Rocky Mountains south of the Great Plains where there are three main ranges: the Laramie Mountains, about 140 miles long; the Sierra Madre range, only about 30 mi (48 m) long; and the Medicine Bow Mountains, stretching over 50 mi (81 km) into the state from the Colorado border.

The Middle Rocky Mountains extend through the central, western, and northwestern parts of the state and contains the Wyoming Range, the Teton Range, the Absaroka Range, the Big Horn Mountains, and the Wind River Range. This phenomenal display of peaks, ridges, and deep valleys includes Gannett Peak in the Wind River Range, Wyoming's highest at 13,804 ft (4,208 m); Grand Teton in the Teton Range at 13,771 ft (4,197 m); and Cloud Peak at 13,167 ft (4,014 m) in the Big Horns. The dramatic rise of the Grand Tetons in northwestern Wyoming, as seen from Jackson Hole, is thought to have formed as two separate blocks of the

Earth's crust shifted, one block pushing the peak upward, while another hollowed out Jackson Hole below. North of the Tetons is Yellowstone, the first national park in the nation. This area is known for its unique geysers, extensive variety of plants and animals, and majestic views.

The largest geographic area is the Wyoming Basins. Situated among the state's various mountain ranges, the landscape spreads out into broad basins, which include the Bighorn Basin and Powder River Basin in the north, the Wind River Basin in the west-central region, and the Green River, Red Desert, and Washakie basins in the southwest. The rather flat and open eastern side of the state, except for the Black Hills region, drops gently into the Great Plains.

Crossing through the center of these basins is the Continental Divide. On the east side of the divide, waters flow into the Missouri-MISSISSIPPI drainage system. On the opposite side, the Colorado and Columbia basins both have major contributors originating in Wyoming. More than 70 percent of the state's lakes, rivers, and streams eventually drain into the Missouri River finally reaching the ATLANTIC OCEAN. There is also a unique area in the Great Divide Basin where water flows neither eastward nor westward but remains trapped instead between one of the watersheds, forming a group of ponds known as Chain-of-Lakes.

The early development of Wyoming was closely linked with the fur trade and followed later by the great westward migrations. Although the French may have been in the area in the late 18th century, it was John Colter who brought fantastic stories to St. Louis in 1810 following several years of trapping in the Wyoming mountains. Some of the more famous of the early mountain men to explore the area include Thomas Fitzpatrick, James Bridger, Jedediah S. Smith, and Jeremiah Johnson. By the 1840s the route west through Wyoming was in steady use by settlers headed toward OREGON and CALIFORNIA and the old fur trading posts become stops along the Oregon Trail. In 1868 the region became the Territory of Wyoming, with Cheyenne as its capital. Although the fur trade entered a state of decline beginning in the 1840s, the territory continued to advance economically as huge herds of cattle were driven up from Texas along the cattle trails. Population growth and economic development continued in the late 1800s. Wyoming joined the Union in July 1890. In 1924, Wyoming became the first state to elect a woman governor, Nellie Tayloe Ross.

Most of the state's residents are either directly or indirectly involved in farming or ranching. The major



dry-farming products include hay, wheat, and barley, and where irrigation is used to supplement the arid conditions, sugar beets and dry beans can be produced. Because much of the land is high desert with little precipitation and sparse grass cover, livestock operations necessitate large grazing areas for each animal. Sheep graze in places unfit for cattle, and both sheep and cattle are allowed to range by permit in the national forests. In 2000, Wyoming ranked second among the states in wool production and third in sheep and lambs.

Mining is the largest sector of the state's economy, accounting for about one quarter of the gross state product. Petroleum is the state's most important mineral; the production of petroleum and petroleum products is centered in Casper. Natural gas is also of considerable economic significance, as well as coal, sodium carbonate, and uranium. Wyoming has the world's largest sodium carbonate deposits and has the

nation's second largest uranium deposits. Considerable amounts of gold, iron, and various clays are also mined. Important manufactures include processed foods and clay, glass, and wood products.

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## xerophytes

BIOGEOGRAPHERS AND ecologists usually classify plants according to their water needs. Since the global distribution of water varies from dry to wet, plants also vary in their adaptation to the availability of water. Xerophytes are plants of the arid regions. The Greek prefix *xero-* means dry in contrast to *hygro-* (wet) and *meso-* (intermediate).

Xerophytes as a class of plants are those that have adapted to dry environments by some mechanism to prevent water loss or to store water in their leaves. While most xerophytes are found in arid environments, some xerophyte plants may also be found in salt marshes, saline soil, or in acid bogs. These xerophytes have adapted to chemically hostile, wet environments. Other xerophytes can be found on beaches, in sand dunes, and on bare rock surfaces even in wet regions where local conditions made some spot dry.

Xerophytes have adapted to arid conditions by storing water in leaves or in stems. They have reduced the rate of water transpiration to a bare minimum. Consequently, they can survive in habitats that dry very quickly because of high temperatures and wind that favor a high rate of transpiration. Many plants in the Mediterranean region used xerophytic adaptations to meet the challenge of the summer dryness. Some, like the live oak, have hard, thick, leathery leaves.

Succulents are plants that store water in their leaves. These plants have leaves that are thickened by a spongy tissue that can absorb water. Agaves and cacti have thick, fleshy stems or leaves. Other xerophytes have waxy leaf coatings or the ability to drop leaves during dry periods. Others have the ability to reposition or fold leaves to reduce sunlight exposure. Others can grow dense, hairy leaf coverings.

Many succulents do not have spines like cacti. Some, such as sedum, come from colder areas. Sedum varieties come from many parts of the world. Important succulents are agave, aloe, crassula, echeveria, hoya, kalanchoe, sempervivum, and yucca.

Cacti are also xerophyte plants that are members of the rose family. They are among the most drought-resistant plants. With water drawn from shallow roots and stored in their stems, they are able to survive long periods without water. The needles on cacti give shade while waxy surfaces seal in moisture. Some xerophytes are members of the spurge family, which contains over 7,300 species, many of which are herbs and shrubs. Some spurge species in Africa are hard to distinguish from cacti when not in bloom.

The American Southwest, which includes the SONORAN DESERT, the Chihuahuan Desert, the Mojave Desert, and the Great Basin Desert, are habitats for a rich variety of xerophytes including cacti. These plants probably originated in the West Indies. Today, there are

hundreds of varieties, including the yucca, prickly pear cactus, the beavertail cactus, and jumping cholla. The plants in each of these deserts varies richly: Some varieties can dominate in one desert but be absent or rare in another. Ranchers in the Southwest see the prickly pear as money in the bank because in times of severe drought, the spines may be burned off with a flame thrower. The cattle can then eat the moisture-filled leaves.

The GRAND CANYON in the UNITED STATES has hygrophytes at the bottom. With increases in elevation, the moisture decreases and the plants change from mesophytes to xerophytes at the desert plateau at the top of the canyon. There are numerous cacti present, along with agave and yucca.

In the deserts of IDAHO and OREGON, xerophytes can be found. The hedgehog cactus, which grows in the high desert, has numerous light-colored spines that help protect the plant by reflecting sunlight. Its thick and rounded shape also helps it retain water because the shape heats more slowly.

In some deserts, like the KALAHARI, the vegetation is xerophytic, but the plants are not true xerophytes. Other deserts with numerous species of xerophytes are those in southern Africa and on the island of MADAGASCAR. Many xerophytes can be found in the deserts of the MIDDLE EAST, BRAZIL, and CHINA.

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## Xinjiang

THE XINJIANG UYGUR Autonomous Region (eastern Turkistan) is one of the CHINA's five autonomous

regions and the largest provincial division. Xinjiang has an area of 635,871 square mi (1,646,900 square km) and a population of 19,250,000, and its capital is Urumqi. Xinjiang borders Tibet, Qinghai, Gansu, MONGOLIA, KAZAKHSTAN, KYRGYZSTAN, TAJIKISTAN, AFGHANISTAN, PAKISTAN, RUSSIA, and INDIA. Natural resources include crude oil, gas, iron, copper, gold, green jade, manganese, expanded perlite, quartz, marble, asbestos, boron, coal, iron, salt, gold, beryllium, lithium, white mica, albite, serpentines, uranium.

One of China's major pastoral areas, Xinjiang has livestock breeding. Local craftspeople produce carpets, leather, and fine cashmere. Hotan is the main jade production center of the world. Agriculture produce includes wheat, corn, cotton, silk cocoons, seedless grapes, and hami melons.

The Kunlun mountain range delimits the southwestern border of Xinjiang, at the southern end of the Pamir and Karakoram range. It also forms the north border of Tibet, eastward from KASHMIR, and delimits the southern border of the TARIM BASIN, occupied by the Takla Makan desert. This, the world's second-biggest desert is enclosed in the north by the TIAN SHAN range, which also forms the southern border of the Dzungar Basin covered by the Dzungarian Desert, closed at the north by the ALTAI MOUNTAINS.

The glaciers of these rugged mountains form all the rivers that run across the basins and oases flanking the Tian Shan mountains. The lakes cover a total of 3,745 square mi (9,700 square km). Tourist attractions include the ancient cities of Gaochang, with the Bizaklik Thousand Budda Caves and Turpan, with grottos enriched by mural paintings. Tianchi is one of the main tourist attractions in China, known as Jade Lake.

In the past, Xinjiang was part of the SILK ROAD and became famous for trading with the Roman and Persian empires. Buddhism came to China from India through Xinjiang. In the 16th century, the economy crashed because of trading routes had changed to the oceans.

Xinjiang, a melting pot, has 47 ethnic groups. Consequently, the region's religion (ISLAM) and ethnicity (Uygur, Hui, Kazakh, and Kyrgyz) are different from the rest of China. Uygur is the spoken language, but Chinese is taught in school. China has engaged in a policy of ethnic migration, shifting Han populations to Xinjiang, so today the non-Han component of Uygurs accounts for 8.4 million of the region's roughly 19 million people. Most Uygurs are excluded from the political system administered by China's capital, BEIJING, and protest violently.



China is characterized by imbalanced regional growth. The coastal regions have more developed infrastructures and are closer to business centers. In 1998, the average gross domestic product (GDP) for coastal provinces was about 2.2 times the average GDP of interior provinces. Since 1999, the development of the interior provinces has received high priority in state policy. The Tarim oil field in Xinjiang is the second-largest oil field on China's mainland, accounting for 30 percent of China's total reserves. It provides, through a west-to-east pipeline and railroad, oil to coastal cities and lessens China's dependence on imported oil.

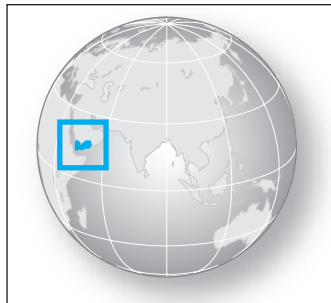
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## Yemen

**Map Page** 1122 **Area** 203,850 square mi (527,970 square km) **Population** 19,349,881 (2003) **Capital** Sana'a **Highest Point** the jabal an nabi shu'ayb 12,335 ft (3,760 m) **Lowest Point** 0 m **GDP per capita** \$800 **Primary Natural Resources** negligible.



YEMEN, NO MATTER how it is defined or what its current political structure, has always controlled the southwestern tip of the Arabian Peninsula—the BAB EL MANDEB choke point to and from the RED SEA. Yemen's neighbors are SAUDI ARABIA and OMAN and the country is about twice the size of WYOMING. It is the closest point to sub-Saharan Africa (especially DJIBOUTI and ETHIOPIA—with which it has had a long historic association. It also has been a major caravan route for land trade from the INDIAN OCEAN to the Arabian Peninsula and on to the MEDITERRANEAN SEA. The recent discovery of the ancient trading city of Ubar was accomplished using remote sensing and satellite images.

In biblical times, Yemen was the home of the queen of Sheba (related to the Sabaean Empire). In Roman and medieval times, it was the center for the lucrative

spice trade, especially frankincense and myrrh. Today, the Yemen desert country has few natural resources of interest to global powers. Its primary asset is geopolitical control of the all-important choke point (Bal el Mandeb) for the Red Sea and Suez Canal (and ultimately the Mediterranean).

In modern times, following North Yemen's independence from the OTTOMAN EMPIRE in 1918, the British took control of the area, especially of the key port of Aden. This was essential for British Empire trade to and from INDIA and the Far East. British control ended in 1967, and three years later, the southern government adopted a Marxist orientation. The massive exodus of hundreds of thousands of Yemenis from the south to the north contributed to two decades of hostility between the states. The two countries were formally unified as the Republic of Yemen in 1990. A southern secessionist movement in 1994 was quickly subdued.

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## Yenisey-Angara River

THE YENISEY AND ANGARA rivers form a dividing line between western and eastern SIBERIA. Like the other major rivers of the region, they flow from highlands in the south across the flat north Siberian plains to the ARCTIC OCEAN. The watershed also includes the subbasin of Lake BAIKAL, the second-largest body of fresh water in the world. Most of the Yenisey-Angara basin is unpopulated because of its severe climate and lack of resources, but a cluster of cities occupy the upper parts of these rivers, where natural resources such as iron ore and gold and the rivers' hydroelectric potential have drawn settlers, mostly from the west, but also some Korean and Chinese immigrants.

The Yenisey-Angara basin covers an area of 996,248 square mi (2,554,482 square km). Nearly half is forested, and the average population density is only 2 persons per square km. There are 10 cities in the basin with populations above 100,000, including Ulan Bator (Ulaanbaatar), the capital of MONGOLIA, which is on the river Orhon, the chief affluent of Lake Baikal. Other large cities include Krasnoyarsk (the regional administrative center) and Abakan on the upper Yenisey, and Irkutsk and Bratsk on the Angara.

Another city, Norilsk, lies a few kilometers to the east of the river near its mouth in the Yeniseyskiy Zaliv (bay), at the point where the forested Central Siberian Plateau meets the TUNDRA of the Arctic coastal region. The upper reaches of both rivers are mountainous and forested—though the portion of the watershed that extends into northern Mongolia is mostly grassland and arid STEPPE. The source of the Yenisey is in eastern Tuva, an autonomous republic of the Russian Federation, in the Sayan Mountains (where the river is called the Ulu-Khem). From here it flows 2,360 mi (3,806 km) almost directly north to the Kara Sea, an arm of the Arctic Ocean.

The Angara begins as the outlet for Lake Baikal and descends rapidly through gorges. Both this stretch and the upper Yenisey have been harnessed for hydroelectric power, creating large reservoirs at Krasnoyarsk

on the Yenisey, and at Bratsk and Irkutsk on the Angara. These electrical and hydrological reserves have been crucial for the development of heavy industry in these areas, notably Krasnoyarsk, one of the coal capitals of Russia.

After the conjunction of the Yenisey and Angara near Yeniseisk, the Yenisey becomes broader and slower as it crosses the Siberian plains. Yeniseisk was once the center of Russia's gold mines and was one of the first outposts of eastward expansion, built in 1618. The river follows the ESCARPMENT of the Siberian Plateau, forming a distinct physical, environmental, and climatic boundary between this hilly region to the east and the vast West Siberian Lowlands to the west. Other tributaries join, mostly from the east, chiefly the Middle and Lower Tunguska rivers. The Yenisey's estuary is about 140 mi (225 km) long. Navigation is possible as far inland as Turukhansk (at the Lower Tunguska), but is hindered by ice for six months of the year. Nevertheless, the Yenisey and its main tributary, the Angara, form some of the only highways in this sparsely populated region.

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## Yucatán Peninsula

THE YUCÁTAN PENINSULA is made up of three states: Campeche, Quintana Roo, and Yucatán, which also include major resort areas such as Cancún, Cozumel, and Playa del Carmen. The Yucatán Peninsula extends northward from Central America and is bordered on the east by the CARIBBEAN SEA and on the north and west of the peninsula by the Gulf of Mexico. The Yucatán Peninsula measures 70,000 square mi (181,300 square km) and is considered a low, flat limestone tableland with coastal rocks dating back to the Pleistocene and Holocene ages; older deposits from the Miocene and Eocene ages are found farther inland. It is located in the southeastern part of MEXICO and has a tropical climate with summers that are often wetter





*The name of the Yucatán Peninsula came from the native Mayan language, meaning "What did you say?"*

then the winters. While a majority of the inhabitants of the Yucatán Peninsula are modern descendants of the Maya people, the area is also very heavily populated with tourists in the three major resort areas.

Because of the region's Mayan history, there are many ruins on the peninsula, of which the major sites are Chichén Itzá, Cobá, Edzna, Kabah, Tulum, and

Uxmal. The Mayan civilization, during its high period, occupied one-third of Mesoamerica. Trade between highlands and lowlands comprised what could best be produced in those areas. For example, the lowlands were generally producing food for personal consumption such as maize, squash, beans, chili peppers, amaranth, manioc, and cotton. The highlands, however, were often extracting heavy minerals, as it possessed obsidian, jade, precious metals, and hematite.

Caves and KARSTS on the Yucatán Peninsula are plentiful and were well used by the residents because inland fresh water was and still is extremely scarce. Cave exploration by the Maya first occurred some 3,000 years ago in an effort to find fresh water. Today pottery shards, charcoal, torches, and artwork are all found in the caves. It is believed that the water in the caves was used not only for survival but for religious ceremonies as well. The caves themselves were used as a refuge from enemies, resting places, and in mining for clay and minerals.

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## Zagreb

ZAGREB IS THE capital of CROATIA, and it is emerging as one of the leading cities of the regeneration of the Balkan Peninsula. Although it is one of Europe's oldest cities, it also is one of Europe's newest capital cities, since Croatia gained independence from Yugoslavia in 1991.

With a population of nearly 900,000 people, Zagreb is much larger than any other city in Croatia and was the second-largest city in the former Yugoslavia. It is the center of most of Croatia's industry, as well as the country's political and intellectual capital. Over 20 theaters and 40 museums draw tourists from all over Central and South Europe. The city has two major components: the Upper Town and the Lower Town, connected by a funicular since the 19th century. The Upper Town (Gornji grad) is the original medieval nucleus of the city, also known as Gradec, surrounded by a 13th-century fortification wall.

This part of Zagreb is dominated by Saint Mark's Church and the Banski dvori, the Ban's Halls (*ban* is the Slavic title for "regional governor"), a 17th-century palace that today serves as the center of Croatia's government. Even older than Gradec is the part of the city surrounding the cathedral that contains the city's main open markets, known as Kaptol. The Lower Town (Donji grad) contains the main city square, Trg bana



*Boskovic Street in Zagreb, the Croatian capital on the Balkan Peninsula; it celebrated its 900th birthday in 1994.*

Jelacica, and the city's other main squares, museums, and public buildings. The Lower Town also contains Croatia's most important art museum, the Mimara, and the National Theatre. Zagreb is located near the Sava River, about 230 mi (375 km) west of Belgrade. Originating at the crossroads of several TRADE ROUTES, Zagreb grew in importance from 1094 when it was

named as the seat of the local bishop, and from 1242, when it was proclaimed a free royal city by the King of Hungary (a status exempting its residents from most taxation and military service). In 1557, it was formally declared the capital of Croatia, and a university was founded here. In much of this period the city was run by German burghers who settled here from Austria, and it was known by its German name, Agram. It was a primary military headquarters for Habsburg defenses against the OTTOMAN EMPIRE to the southeast, a fact reflected in much of the militaristic architecture of the city. Today, Zagreb is famous for its animated film productions and is home to the School of Animated Film and the International Festival of Animated Films.

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## Zagros Mountains

THE ZAGROS MOUNTAINS are a complex chain of mountains and ridges in the westernmost part of IRAN. The range divides the region between the fertile plains of Mesopotamia and the Persian Gulf lowlands to the west, and Iran’s dry inland plateau to the east. The ridges run roughly northwest to southeast, 930 mi (1,500 km) in length, from Kurdistan to the Straits of Hormuz. Called Kuhha ye Zagros in Persian, the peaks and valleys of this range have provided a fertile home for the Persian people since prehistoric times and an effective barrier to the expansive tendencies of their more richly endowed neighbors to the west in the FERTILE CRESCENT. Some of the oldest and most important Persian cities are within the bounds of these mountains: IS-PHAHAN, Persepolis, Shiraz, and Kermanshah. Today, most Iranians live in the broad valley between the Zagros ranges and the Kuhrud Mountains, a parallel range about 186 mi (300 km) to the east.

The Zagros Mountains are roughly the same age and have the same formation history as the ALPS—caused by folds in the Earth’s crust as the African and Arabian plates collided with the Eurasian Plate over 100 million years ago. The different ridges each have their own particular characteristics: in the central

foothills of the western side of the range are the primary oil fields of Iran. Salt domes are also common in the center of the range, some as tall as 5,000 ft (about 1,500 m). The southern ranges tend to be lower, below 13,200 ft (4,000 m), with more limestone rock. The tallest mountains, those over 14,850 ft (4,500 m), are located in the center of the range, including the tallest peak in the range, Zardeh Kuh (14,920 ft or 4,548 m). The Zagros range, in general, is characterized by sheer rugged peaks and steep canyons and gorges.

The mountains encompass several lakes as well, including Iran’s largest inland body of water, Lake Urmia. Few rivers flow year-round, and most of the small streams flow west into the Tigris River basin or across the narrow coastal plain into the PERSIAN GULF and the Gulf of Oman, or eastward into salt lakes, to evaporate in the dry interior.

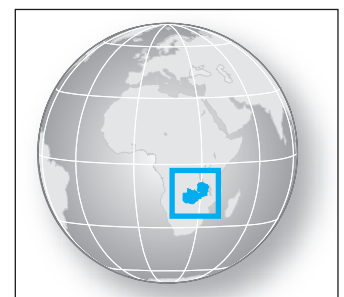
Because of their elevation, the Zagros Mountains have a more subtropical climate than the drier areas below. Winds from the west bring moisture off the Persian Gulf. There is generally heavy snow in winter, the most in the far northwest, where snow stays on the peaks year-round. Meltwater from winter snows is vital for Iran’s water supply. The Zagros Mountains are important environmentally because of their biodiversity resulting from the region’s varied topography and climate. An initiative by the government of Iran has been established to protect this diversity and has created several protected areas.

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## Zambia

**Map Page** 1116 **Area** 290,584 square mi (752,614 square km) **Population** 10 million **Capital** Lusaka **Highest Point** 7,549 ft (2,301 m) **Lowest Point** 1,079 ft (329 m) **GDP per capita** \$302 **Primary Natural Resources** copper, zinc, lead, coal, gold.





ZAMBIA IS LOCATED in central Africa and is slightly larger than the state of TEXAS. It is completely LAND-LOCKED, with the Zambezi River forming a natural boundary between Zambia and ZIMBABWE to the south. Zambia is also bordered by CONGO to the north, by TANZANIA to the northeast, by MALAWI to the east, by MOZAMBIQUE to the southeast, by ANGOLA to the west, and by BOTSWANA, NAMIBIA, and Zibambwe to the south.

The Cuando River forms part of the Angolan-Zambian border. The Luapula River forms the western border with Congo in the northeast part of Zambia. Along the northern border are Lakes Mweru and TANGANIKA. Bangweulu Lake is in the northeast along with the Muchinga Mountains. These mountains reach up to the Nyika Plateau at 7,120 ft (2,170 m). Zambia is a fairly uniform plateau of granite with an average altitude between 3,280 ft (1,000 m) and 4,265 ft (1,300 m).

The Zambezi River, running along the southern border of Zambia, is one of the most scenic rivers in the world. The Zambezi flows over a series of waterfalls and rapids such as the Ngonye and Ngambwe rapids, the Kariba Gorges, and the famous Victoria Falls.

Victoria Falls is approximately 1 mi (1.6 km) wide with a maximum drop of 420 ft (128 m). David Livingstone, a British explorer traveling in the area in 1855, named the falls after British Queen Victoria. Victoria is actually a series of falls separated along the top by a series of islands. After flowing over Victoria Falls, the Zambezi River flows into Lake Kariba, which was formed by the Kariba Dam and is one of the largest artificial lakes in the world. It then flows through central Mozambique and finally out into the Mozambique channel of the INDIAN OCEAN.

## WILDLIFE

There are several swampy areas in Zambia, including Bangweulu Swamp in the northeast, Lukanga Swamp and Kafue Flats in the center, and Luena Flats and Busanga Swamp in the west. Within these areas are large concentrations of animals, including elephants, lions, rhinoceroses, and several types of antelopes. Zambia has created 19 national parks that make up 8 percent of the land area of the country. The largest of these is Kafue National Park, just west of the center of Zambia, and North and South Luangwa National Parks in the east. Being a hub in the heart of the African continent where southern and central Africa converge, Zambia is also a convergence of the people of Africa.

There are about 75 languages and dialects spoken in Zambia, with just as many ethnic groups. Most of these speak Bantu dialects, but the official language is English.

The major tribal groups in Zambia are the Tonga to the south, the Kaonde to the northwest, and the Bemba, Bisa, and Lala to the northeast. Most of the tribal groups are very small, and each constitutes less than 2 percent of the population. Zambia became independent from the UNITED KINGDOM on October 24, 1964. From that time on, it has been a constitutional republic with a multiparty democracy and a president who is elected to five-year terms.

Zambia is one of the world's largest producers of copper. The copper belt in northern Zambia has the greatest population density in the country because of all the original employment in the mines. Copper prices have been declining for over 30 years, which has not helped the Zambian economy.

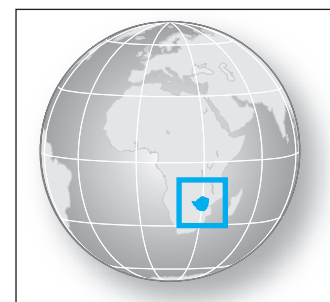
Zambia is one of the poorest countries in the world by per capita annual income and yet it is one of the most urbanized countries in Africa. Unemployment and underemployment are major problems in Zambia, along with the rapidly expanding population that is increasing at a rate of 2.3 percent per year despite declining national life expectancy.

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## Zimbabwe

**Map Page** 1116 **Area** 150,803 square mi (390,580 square km) **Population** 12,671,860 **Capital** Harare **Highest Point** 8504 ft (2,592 m) **Lowest Point** 531 ft (162 m) **GDP per capita** \$1,900 **Primary Natural Resources** corn, cotton, wheat, coffee, peanuts.



ZIMBABWE IS a LANDLOCKED country in southern Africa. It is bordered by SOUTH AFRICA, MOZAMBIQUE, BOTSWANA, and ZAMBIA. The name *Zimbabwe* comes from the Shona words *dzimba dza mabwe*, or “houses of stone,” a reference to the stone ruins of the kingdoms of Great Zimbabwe.

Dating back to the 13th century, Zimbabwe consisted of a series of kingdoms of stone settlements known as *zimbabwes*. The largest of the kingdoms was the Great Zimbabwe, lying 300 mi (483 km) south of the Zambezi River and 250 mi (402 km) from the INDIAN OCEAN. The kingdoms represent the most extensive and extraordinary group of ruins in Africa. They have been dubbed the greatest stone monuments in Africa, aside from Egypt. Archaeological evidence shows elaborate stone structures that were enclosed by walls about 20 ft (6 m) thick and 35 ft (11 m) high. The evidence also shows that Great Zimbabwe had a well-organized social and political structure, culminating in trading in gold, ivory, copper, and beads. While it is not clear why the Great Zimbabwe collapsed, scholars believe the decline began as a result of European activities, particularly Portuguese’s disruption of the trade networks in southern Africa between the 16th and 19th centuries.

The legacy of the Great Zimbabwe can be found among 71 percent of Zimbabweans who speak Shona. Other languages include Ndebele at 16 percent of the population, and the remaining 13 percent is spread among the Tonga, Venda, and Sotho.

Unlike many African countries, Zimbabwe (formerly Rhodesia) was never directly colonized by a European power. The origins of Rhodesia lie largely in the vision, ambition, and enterprise of Cecil Rhodes. In 1889, Rhodes successfully petitioned the British government for a Royal Charter for his British South Africa Company (BSA). The British government granted the charter and delegated nearly all administrative responsibility as well as commercial rights in greater Rhodesia to the BSA. In 1924, the BSA administration was dissolved and Southern Rhodesia became a self-governing British Crown colony.

Self-government was, in fact, confirmed to the white-settler community, which grew rapidly but was never more than 5 percent of the population. In 1953, the British government consolidated its territories by creating a federation of South Rhodesia (Rhodesia), Northern Rhodesia (Zambia), and Nyasaland (MALAWI). The purpose of the federation was to establish a multiracial region; however, the majority blacks viewed this federation with skepticism and as another attempt

by whites to maintain power over a predominantly black Africa. In 1963 the British government conceded to pressure by African nationalists and granted independence to Malawi and Zambia. Rhodesia, however, was denied independence. For some time it felt like there would be a black majority role in South Rhodesia. Blacks built an effective political movement and challenged the dominance of white rule. Sensing the evolving political aspiration of blacks, the minority whites elected the Rhodesia Front (RF) in 1963. The platform of the RF was to uphold white supremacy through any means. The new government used its power and suppressed emerging black nationalist movements such as the Zimbabwe African People’s Union (ZAPU) and Zimbabwe African National Union (ZANU).

By 1965, the Rhodesia government under the RF, now led by Ian Smith, felt it could no longer negotiate with Britain for its future status, and by its Unilateral Declaration of Independence (UDI) it refused to bow to outside opinion. In so doing the Rhodesian government brought the wrath of Britain and the world at large upon itself.

In 1967 the United Nations imposed mandatory economic sanctions against the RF regime. Unfortunately, the sanctions failed because other countries, particularly the apartheid government in South Africa, continued to trade with Rhodesia. It became apparent that blacks had the burden of removing the RF regime from power. ZAPU and ZANU went underground and began an armed struggle in 1966.

With the RF regime’s inability to stop the guerrilla campaign by the ZAPU and ZANU, the government proposed a power-sharing agreement in 1978. However, the agreement concentrated power in the hands of the minority whites, which led to an escalation in the armed struggle. In 1979 a compromise was reached at a meeting in Lancaster House, LONDON. The compromise opened the door for majority black rule in the history of the country. In 1980 Zimbabwe became an independent country, and Robert Mugabe, the leader of ZANU, became the first black prime minister.

The black majority inherited an economic, social, and political structure previously built on race. Since the 1980s the Mugabe government has worked to dismantle the economic gap between blacks and whites. These effects have included improving the livelihood of blacks and redistributing land.

However, the racial harmony that has existed since independence fell apart in early 2000. Facing a major political challenge from the Movement for Democratic

Change (MDC), the Mugabe government encouraged the veterans of the liberation movement to take over white-owned farms. The ensuing takeovers and intimidation propelled Mugabe to a narrow and disputed election victory in 2002. Unfortunately, such upheavals have created severe economic difficulties for all Zimbabweans.

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## zones of convergence/divergence

A BROAD AREA WHERE two tectonic plates are colliding is a zone of convergence. An area where plates are moving apart is a zone of divergence. Convection in Earth's mantle drives the two motions. Convergence occurs above descending limbs of convective cells, whereas divergence takes place above cells' rising limbs. The two zones' geologies are similar in many ways—they both have mountain building, earthquakes, and volcanic eruptions—but their geologies also differ in important ways.

### ZONE OF DIVERGENCE

This zone is due to seafloor spreading or continental rifting, which may lead to seafloor development. Spreading occurs as basaltic magma from the mantle rises into vertical tensional fractures in the lithosphere. This zone is constructive, as volcanism adds basalt rock to the lithosphere. Midocean ridges, rift valleys, normal (dip-slip) and strike-slip faulting, and basaltic volcanism characterize the zone of divergence.

Two kinds of undersea mountain ranges—oceanic ridges and rises—make up the largest zones of divergence. The faster the spreading rate is, the broader and lower the mountain range appears. Rises are low mid-oceanic ridges because their spreading rates are faster. For example, the East Pacific Rise between the Pacific Plate and the Nazca Plate is gently sloping because spreading rates are 6.5 in (16.5 cm) per year. Ridges, on the other hand, stand higher above the seafloor because spreading rates are slow. For instance, the

spreading rates of the Mid-Atlantic Ridge are 0.8–1.2 in (2–3 cm) per year. Central rift valleys tend to occupy the axes of the ridges; the only exception is when spreading rates are too fast for valleys to form. The East Pacific Rise lacks a central rift valley for the most part. The eastern Africa rift system is an example of a divergent zone on land. The nearby RED SEA and Gulf of Aden represent more intense spreading than that of the African rift area.

### ZONE OF CONVERGENCE

This zone forms the boundary between two tectonic plates that are coming together. Compressional stress in the lithosphere occurs as the plates approach each other. In most instances, this zone is destructive, as the demise of rock by means of subduction usually takes place here. Subduction, oceanic trenches, folding, reverse (dip-slip) faulting, and andesitic (explosive) volcanism characterize the zone of convergence.

There are three types of convergent plate boundary zones. An oceanic plate collides with a continental plate to create an ocean-to-continent boundary. The oceanic plate is made of denser, heavier mafic rock (e.g., basalt), so it subducts, forms an oceanic trench, and melts to form magma beneath the continental plate. The magma rises, melts sialic rock (e.g., granite) of the continental crust, and becomes explosive andesitic magma.

Volcanoes that form along the edge of the continent experience some of the world's most violent eruptions as a result. The collision also creates massive folded mountains on the continent's edge. The Peru-Chile trench and the ANDES MOUNTAINS area between the Nazca and the South America plates is an example of an ocean-to-continent boundary zone. The second convergent boundary is the ocean-to-ocean type. Neither of the convergent plates have a continent, but one of the oceanic plates is made of slightly denser rock and therefore subducts. An oceanic trench and a volcanic island arch-trench system develop. The magma tends to be more basaltic than andesite, and volcanic eruptions are therefore usually less explosive.

The western side of the PACIFIC OCEAN has numerous convergent zones of this type; the Mariana Islands and the Mariana trench are a classic example. A third convergent boundary zone forms from a continent-to-continent collision, that is, the collision of two tectonic plates with continents on them. *Suturing* is a term that describes this type of convergence. Hardly any subduction takes place at the time of collision, so the zone is generally volcano-free, but intense crustal folding and

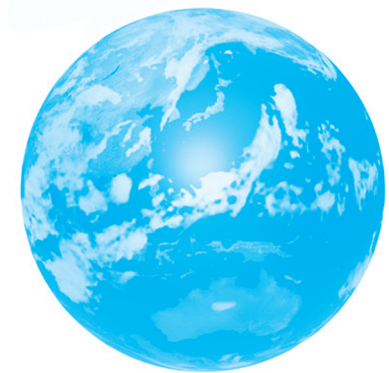
mountain building take place. The area of the HIMALAYAS in Asia is a classic example of this type of convergent boundary zone.

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*Old Farmer's Almanac*  
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*Polar Geography*

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## Glossary

### **Absolute Location**

The exact location of a place as determined quantitatively through the use of a spatial coordinate system, such as a geographical information system (GIS) or a global positioning satellite (GPS).

### **Access Point**

A particular place of connection that allows something to gain entry to some spatial network of places.

### **Accessibility**

A qualitative or quantitative appraisal of the ease with which a particular place can be accessed and interacted with from other locations. Accessibility implies proximity to or distance from to some specific object or location.

### **Acculturation**

Form of cultural development where a cultural group or individual assumes the characteristics of a more sophisticated or dominant society.

### **Agglomeration**

1) The spatial connection found between the various activities of human production. 2) The spatial concentration of people and/or their activities. Major metro-

politan areas such as the U.S. northeast coast cities (Boston, New York, Washington, D.C.) are agglomerations.

### **Agrarian Reform**

The redistribution of the ownership of agricultural resources. This type of agricultural redistribution has occurred in various nations throughout the history of humankind.

### **Agricultural Density**

The ratio between the total human population for a defined area and the number of people working as farmers per unit of cultivated land in this area.

### **Animism**

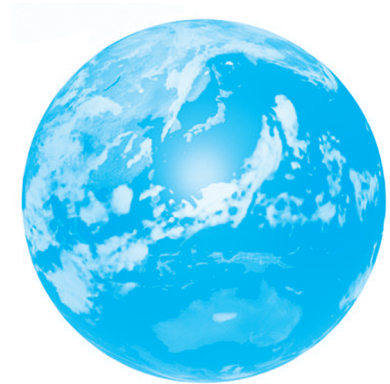
A belief that natural objects can become the home of deceased individuals, spirits, or gods. Sometimes these objects can appear to be alive.

### **Antecedent Boundary**

A questionable boundary that was set up between nations or peoples for an area before it was more fully populated.

### **Anthropogenic**

An adjective for the change on a natural system due to the activities of humans.



**Anthropogenic Landscape**

A natural landscape that has been altered by human activities.

**Apartheid**

South African policy of separating races from each other. South Africans were classified as being of black, white, colored, or Asian races. This policy no longer exists.

**Aquaculture**

The raising and cultivation of aquatic animals and plants for market and consumption.

**Areal Differentiation**

The description and explanation of the factors responsible for the spatial patterns seen in physical and human phenomena found on our planet.

**Areal Integration**

The description and explanation of the connections, interactions, and amalgamation that occurs between places, landscapes, and regions.

**Automated Mapping**

The production of maps using computers, software, and electronic printing devices.

**AVHRR (Advanced Very High Resolution Radiometer)**

A radiation-detection sensor found on a number of remote sensing satellites for weather conditions on Earth. It is primarily used to measure cloud cover and the surface temperature.

**Balfour Declaration**

Refers to two important British government policy statements connected with conservative politician Arthur Balfour. The first declaration, in 1917, has been generally interpreted as committing Britain to the establishment of a Jewish national home in Palestine. The second declaration of 1926 acknowledged the self-governing Dominions of the British Empire as fully independent states.

**Balkan Peninsula**

Region in southwestern Europe that borders the Adriatic and Ionian Seas to the west, the Mediterranean Sea to the south, and the Black and Aegean Seas to the East. States found in this region include Albania, Bulgaria, Greece, Romania, part of Turkey, and the countries of the former Yugoslavia.

**Balkanization**

The fragmentation of a once unified political area or state into several smaller politically independent regions. This term owes its origin to the breakup of larger political units found in the Balkan Peninsula into smaller countries during the 19th and 20th centuries.

**Barrio**

- 1) A neighborhood in a larger city that can be economically poor.
- 2) A Spanish-speaking area of a city in the United States.
- 3) An urban area in a Spanish-speaking state.

**Berlin Conference**

The 1884 conference in Berlin of European state powers to regulate the colonization of Africa primarily for reasons of trade.

**Biofuels**

Type of combustible liquid or solid fuel produced from the biomass of animals and plants. Ethyl alcohol is a type of biofuel made from plant biomass.

**Birthrate**

Rate at which births are occurring in a population. Often measured as the number of individuals born per unit time or as the percentage of births in the population per unit time.

**Boundary**

An imaginary line spatially separating one political unit from another.

**Brain Drain**

The loss of highly educated and technically trained people by way of emigration.

**Bubble Economy**

Situation where the value of some type of commodity market rises to a point where it cannot be justified on fundamental economic principles.

**Buffer State, Buffer Zone**

An area between two bordering states that is setup to reduce conflicts.

**Cartogram**

A map that describes thematic data in a quantitative way. Often this map is not drawn to scale and the items it depicts are distorted or exaggerated for a specific visual effect.

**Cay**

A small island with low relief composed mainly of sand deposits or coral.

**Central Business District (CBD)**

A zone within an urban area that contains a heavy concentration of office and retail activities.

**Central Place Theory**

Geographical theory that tries to explain how urban settlements are located in relation to each other given the amount of market area and commerce each place controls.

**Centrifugal Forces**

Events or actions that divide or pull a state apart.

**Centripetal Forces**

Events or actions that strengthen and unite a state.

**Chain Migration**

The process whereby a new resident immigrant sponsors one or more other people (usually relations) for legal immigration into a state. Once admitted, these individuals then sponsor several others themselves.

**Choke Point**

- 1) A narrowing in a channel that reduces the flow.
- 2) A location of congestion or impasse.
- 3) A narrow international waterway that connects two larger water bodies.

**Circular Migration**

Type of human migration where an individual migrates to a new location and then returns to their place of origin in repeated cycles. Sometimes driven by the seasonal availability of work.

**Cognitive Behaviorism**

Idea that suggests that the mechanisms of human information processing determine a large portion of our behavior.

**Collective Farm(s)**

A farm or organized collection of farms that is managed and worked cooperatively by a group of laborers usually under state supervision. Common in communist countries.

**Collectivization**

The act of creating a communal or collective farm.

**Colonialism**

System where one or more states control and maintain a foreign possession often for economic exploitation.

**Columbian Exchange**

The widespread exchange of agricultural plants and animals between the Eastern and Western Hemispheres since 1492, the year Christopher Columbus discovered America.

**Commonwealth of Independent States (CIS)**

A confederation consisting of 12 of the 15 states of the former Soviet Union that was first established in 1991.

**Compact State**

A state that has a roughly circular, oval, or rectangular shape and the distance from its geometric center to any point on the boundary is approximately equal. For example, Poland or Zimbabwe.

**Concentric Rings (Urban Geography)**

Circular zones of different urban land use found around an urban area's central business district.

**Concentric Zone Theory**

A theory in urban geography that suggests the patterns of urban land use appear as a number of concentric zones or rings extending from a core central business district. Each concentric zone represents a different type of use. Compare with the sector model.

**Connectivity**

A measure of the extent various places are linked to each other usually through transportation or communication.

**Contiguous Zone**

A zone 24 nautical miles wide extending from land's edge out into an ocean or a sea that includes a state's territorial sea.

**Core Area**

An area within a state that is the main hub of industry, has the most advanced technologies, densest populations, and greatest wealth, and is the center of trade and commerce. Outlying areas from the core are called the periphery.

**Corridor**

- 1) A strip of densely populated land that connects two or more urban areas.

2) A narrow area of land from one state that projects into another state.

**Crude Birth Rate**

Number of live births per 1,000 individuals per year for a specific geographical area.

**Crude Death Rate**

Number of deaths per 1,000 individuals per year for a specific geographical area.

**Cultural Assimilation**

The incorporation of ideas and materials from another human culture.

**Cultural Diffusion**

The spread of human cultural ideas and materials that occurs independently of population migrations.

**Cultural Geography**

The geographical study of the processes by which space, place, and landscape influence human culture and the way culture affects space, place, and landscape.

**Cultural Imperialism**

The process whereby the culture of one state is promoted in another because of economic or military dominance.

**Cultural Landscape**

The alteration of the natural landscape by the cultural activities of humans.

**Culture Hearth**

A place from which important ideas, cultural traits, and technology develop and subsequently diffuse to surrounding places and cultures.

**Death Rate**

Rate at which deaths are occurring in a population. Often measured as the number of individuals who die per unit time or as percentage of births in the population per unit time.

**Decolonization**

The process of colonies being liberated and evolving into independent states.

**Demarcation**

The process of determining the location of geographical boundaries.

**Demographic Transition**

Theory that suggests that the industrialization of a state leads to declines in human death rates followed by declines in birthrates.

**Demography**

The study of human population dynamics.

**Dependency Theory**

Theory that suggests the problems of underdevelopment in third world states were caused by external factors associated with political and economic decision making in rich countries like the United States and Great Britain, which control the world economy.

**Diaspora**

The spatial dispersion of a once congregated group of people. For example, the dispersal of the Jews from ancient Palestine because of the conquest of the Judean kingdom by the Babylonians in the 6th century B.C.E.

**Diffusion**

The movement or transfer of ideas, customs, material objects, or a population from a point of origin to surrounding areas.

**Distance Decay**

The decline in the activity, function or interaction of some process with increasing distance from the center of its origin.

**Distribution**

The pattern that something takes across space.

**Domestication**

The human use of animal and plant species for the controlled production of food and other goods.

**Economic Convergence**

Process whereby once separate economies associated with regions or states combine with other such units to create a larger and more efficient economy.

**Economic Geography**

The geographical study of the processes that influence economic activity at the local, regional, and global scales.

**Economies of Scale**

A situation where the average unit cost of producing a good or service declines as the volume of production increases.



**Elongated State**

A state that has a territory that is much longer than its width. For example, the country of Chile would be considered an elongated state.

**Emigration**

- 1) The process of people permanently leaving a state to live legally or illegally in another country.
- 2) Migration of an organism out of an area for the purpose of changing its residence permanently.

**Enclave**

A situation where the territory of one state is surrounded by the territory of another state.

**Endemism**

- 1) Something that is local to or special to a particular area, region, or people.
- 2) A species that is native to or restricted to a certain area.

**Entrepot**

A place where goods are shipped to, stored, and then shipped to other places. Most port cities are entrepots.

**Environmental Determinism**

A theory that suggests the physical environment, rather than social factors, determines culture.

**Epidemic**

A disease that affects a significant quantity of people or other organisms in a geographical area.

**European Union (EU)**

An organization of 25 European states (2005) established to deal with issues between its members.

**Exclave**

The part of a state that is surrounded by the territory of another country.

**Exclusive Economic Zone (EEZ)**

A zone extending 200 nautical miles from the coastal edge of a state. In this zone, the state has sovereign privileges to the living and non-living resources on the seabed, subsoil, and waters lying above the seabed.

**Expansion Diffusion**

Form of diffusion where the phenomenon being dispersed remains intact or intensified in its area or origin. Compare with relocation diffusion.

**Extraterritoriality**

An idea that suggests the property of one state lying within the territory of another country actually forms an extension of the first state. This concept is often applied to embassies and consulates.

**Federal State**

A state that has strong internal divisions or provinces because of a weak central government.

**Federation**

A state that contains a number of self-governing regions.

**Feeder Routes (Trade)**

Less important trade routes that connect and supply major routes of trade.

**Fertile Crescent**

Historic region of the Middle East that includes all or pieces of Israel, the West Bank, Jordan, Lebanon, Syria, and Iraq, where once fertile conditions supported significant agricultural production and civilizations in the past.

**Forced Migration**

The often-permanent migration of a person because of factors forcing their will.

**Formal Region**

A limited area or region where a single feature or limited combination of features dominate the landscape in an almost uniform fashion. This fact makes this area distinct from adjacent regions.

**Forward Capital**

The founding of a city by a state for the purpose of increasing political control or economic development in a region.

**Fossil Water**

Ancient reserves of groundwater that accumulated over extremely long periods of time.

**Fractal**

A geometric object that consists of both random and organized mathematical aspects.

**Fractal Landscape**

A geographical phenomenon whose surface or pattern can be modeled with fractal mathematics.

**Fragmented State**

A state that has a territory that contains remote, separated, or discontinuous areas.

**Free Trade Area**

A region where barriers to trade are minimized.

**Frontier**

The area found beyond the economically integrated region of a state where expansion can take place.

**Functional Region**

- 1) A region that is distinguished by some feature or activity that occurs within it.
- 2) An area of our planet that can be accepted as a functioning unit based on some type of grouping criteria.

**Gentrification**

The process of renewing and renovating housing by middle and upper income groups in degenerated inner-city areas. This process can displace lower-income groups.

**Geodemographics**

The analysis of demographic data with a spatial focus.

**Geometric Boundary**

A geographic boundary that has no apparent physical origin and is formed mathematically by one or more lines and/or arcs. For example, lines of latitude or longitude on a map. Also called artificial boundary.

**Geopolitics**

The spatial or geographic study of political and economic phenomena.

**Ghetto**

Often an urban area where people from a defined ethnic, cultural or religious groups live.

**Globalization**

- 1) The facilitation of cultural, political, and economic transfer among states with the purpose of creating greater interconnectedness between world areas.
- 2) Economic process whereby multinational corporations leverage the less expensive human labor and natural resources of developing states to increase profits.

**Golden Triangle**

The borderland region of Thailand, Myanmar (Burma) and Laos. Historically, this area was home to a thriving narcotics economy.

**Grassification**

Conversion of tropical rain forest or savanna by human activities into a grassland land type, often done to support range animals.

**Group of 8**

Coalition of the major industrial states: the United Kingdom, France, Germany, Italy, Japan, Canada, the United States, and Russia. Formed in 1976, for the purpose of discussing and resolving economic issues. Russia is the most recent member.

**Growth Pole**

The intentional organization of economic activities around one or more high-growth industries.

**Guest Worker**

A worker from another country who seeks temporary employment in a foreign state.

**Heartland**

The central zone of a state or continent that is economically or culturally important.

**Heartland Theory**

First proposed by Halford Mackinder, this idea suggested that the major powers of the 20th century world would be those states that controlled the most land rather than the seas.

**Hegemony**

The domination of one state over its allies not necessarily through visible interference.

**Hierarchical Diffusion**

Type of diffusion, transfer of ideas, customs, material objects, or a population, that proceeds in an orderly fashion through various levels of a hierarchy.

**Hierarchy**

A situation where a feature or a thing is organized and ordered into connected functional groups.

**Hinterland**

An area of economic influence that extends from a town or city.

**Homelands**

Refers to the independent territories created for blacks under the South African system of apartheid, which is now defunct.

**Houseyard**

A subsistence rural property that is matriarchal in function and organization.

**Hydraulic Civilization Theory**

The idea that ancient civilizations like Egypt and Mesopotamia arose because of the availability of reliable irrigation water from rivers, which made extensive agriculture possible.

**Hydropolitics**

The study of political conflict and cooperation among states over shared water resources.

**Ice Age**

Period of time when glaciers dominate the landscape of the Earth. The last major Ice Age was during the Pleistocene epoch.

**Iconography**

The study and interpretation of artistic representations with religious or secular meaning.

**Immigration**

- 1) The process of people permanently moving legally or illegally from one state to another.
- 2) Migration of an organism into an area for the purpose of changing its residence permanently.

**Indigenous Peoples**

- 1) The people living in an area before colonization of the area by a state.
- 2) The people living in an area of a state prior to its formation, but who do not identify with the state.
- 3) The descendants of either of the above definitions, also known as natives.

**Informal Sector**

A range of market activities employed to succeed in an economic environment where earning opportunities are scarce or to avoid state regulations and laws.

**Infrastructure**

The organization of services, equipment, and facilities required to sustain various forms of economic development.

**Insurgency**

A purposeful campaign of violence caused by dissident groups in a society with the general overall aim of overthrowing a state's political system.

**Insurgent State**

A state that is undergoing or has recently undergone insurgency.

**Intercropping**

Farming practice of growing two or more crops at the same time in the same field. This process is often associated with sustainable agriculture.

**Intermontane**

Something that has a distribution in the middle of mountains.

**Internal Migration**

Migration of humans occurring within a nation-state or region.

**International Migration**

Migration of humans occurring between states.

**Intervening Opportunity**

A situation where the presence of something causes some type of economic activity not to occur. For example, about 100 years ago few forest products from the Pacific Northwest went to the east coast of North America because this region exploits trees in its immediate area.

**Irredentism**

The overall desire of people belonging to a state to integrate all areas that have ever been part of the state and/or any areas that have become a new home to their people into the current state.

**Irrigation**

Agricultural process whereby natural moisture is supplemented with water from other sources, including groundwater and rivers, to grow crops.

**Juxtaposition**

A situation where things are spatially positioned close or next to each other.

**Kibbutz**

A collective farm or settlement, found in modern Israel, where its members share various labor activities.

**Kleptocracy**

An extreme form of government whose purpose is to generate wealth for the politicians and bureaucrats at the expense of the public.

**Land Alienation**

Process where landowners grant certain rights of their land to another person, group or government.

**Land Reform**

The transfer of agricultural land ownership to other groups or to the government for usually collective farming use.

**Land Tenure**

- 1) System that gives individuals the right to hold property.
- 2) The conditions of service that an occupier of land gives to the landowner for the use of his land.

**Landlocked**

Being surrounded completely or almost completely by land.

**Latifundia**

Large farm estates that specialize in growing crops for export. Earliest form of these estates dates back to ancient Rome. This term is often used to describe the farm estates, or *haciendas*, of colonial and post-colonial Mexico, Argentina, and Venezuela.

**Levant**

Region in the eastern Mediterranean.

**Location Theory**

In its broadest sense, the idea that cause and effect relationships exist between various factors and geographic entities.

**Maghreb**

A region in northwest Africa that includes parts of Algeria, Libya, Morocco, and Tunisia.

**Mainland-Rimland Theory**

Idea proposed by Nicholas Spykman that suggests the states that succeed in world domination will be those that control the most coastal fringe land.

**Maquiladora**

A factory, often located in Mexican border towns, that imports raw materials and equipment on a duty-free and tariff-free basis for assembly or manufacturing.

**Marchland**

Zone consisting of the area on either side of a boundary of a state or a region.

**Maritime Boundary**

Political boundary located on an ocean or a sea.

**Medical Geography**

The study of the spatial aspects of disease, disease transmission, diffusion, and other health-related phenomena.

**Medina**

- 1) City in the Hejaz region of western Saudi Arabia.
- 2) The old central core of a traditional Islamic city.

**Megacity**

A city whose population is greater than 10 million people.

**Megalopolis**

Describes a zone where two or more cities become connected because of urban growth. This term was originally used to describe the urban zone between Boston and Washington, D.C.

**Mercantilism**

- 1) The situation where states controlled the economic activities of their colonies. States that practiced this often believed the colony existed for the economic benefit of the controlling country.
- 2) An economic system common to most European countries and their colonies during the 16th to 18th centuries. This system believed prosperity depended upon its supply of gold and silver and by maintaining a favorable balance of trade.

**Mestizo**

Spanish term describing people of mixed European and Amerindian racial origin. Also used in the Philippines to describe people of mixed native Filipino and any other racial lineage.

**Metropolis**

A very large city that is often the capital or the main urban center of a state or a region.

**Microstate**

A state that is in a relative sense quite small in terms of population and/or territory, such as Liechtenstein or Vatican City.

**Military Geography**

Study of the spatial aspects associated with military phenomena.



**Minifundia**

Small farms cared for by peasants or tenants who produce enough food for subsistence and market.

**Monocrop Production**

Form of agriculture where only one crop is grown on an extensive field.

**Monroe Doctrine**

Policy proclaimed by President James Monroe in 1823 to Congress that suggested the United States would not tolerate European military meddling in the affairs of states found in the Western Hemisphere. This policy also stated the intention of United States to stay neutral in European wars and conflict in European colonies.

**Mosaic Culture**

A very diverse culture.

**Multinational Corporation**

Company that has operations in two or more international states.

**Nation**

A group of people sharing a common language, culture and/or ethnicity.

**Nation-State**

A state that is mainly composed of a homogeneous group of people or one nation, often referred to as a country.

**Natural Hazard**

A natural process or event associated with the physical environment that produces negative effects on life.

**Natural Increase Rate**

Statistic of human population growth that is determined by the crude birth rate minus the crude death rate.

**Neocolonialism**

The indirect maintenance of pre-World War II economic and political relationships of wealthy states over countries of the underdeveloped world. Often mentioned as a reason for unequal distribution of wealth between the world's various states.

**Network (Transport)**

A system that consists of an organizing pattern of connecting paths for the purpose of transportation.

**Nomadism**

Cultural tradition where groups of people continually move from one place to another to maintain their livelihood, rather than settling down in one location.

**Offshore Banking**

Situation where a citizen or company of one state uses the banking operations of another country. This is usually done to escape more restrictive domestic banking operations, rules, taxes, and regulations.

**Organic Theory of the State**

Idea proposed by Friedrich Ratzel that suggests the formation and development of a state have stages that are similar to the growth of an organism. In this theory, development was measured in stages of youth, maturity, and old age, with possible rejuvenation.

**Organization of Petroleum Exporting Countries (OPEC)**

Organization of states that formed in 1960 for the purpose of regulating the production and trade of petroleum. Now consists of thirteen countries and controls 85 percent of world petroleum production.

**Oriental**

Something associated with the states of eastern Asia, in particular China and Japan.

**Outback**

The isolated interior region of Australia where human population densities are low.

**Pandemic**

An epidemic that influences people or other organisms over a global or almost global scale.

**Particularism**

Commitment of an individual to a group's interests.

**Pastoralism**

A way of life where a group of people depends on pastures for maintaining their livestock.

**Perforated State**

A state whose territory is interrupted by the presence of another smaller state completely within its boundaries.

**Periodic Market**

A type of traditional marketplace found in third world states that comes about every four to eight days to meet the needs of a dispersed population.

**Periphery**

A less industrialized hinterland that sees minimal flow of manufactured goods because of an incomplete development of a commercial market.

**Physiographic Boundary**

A boundary established on physical features in the environment such as river or mountains.

**Physiologic Density**

A method of measuring population density relative to the amount of arable land.

**Place**

- 1) A location that has both distinctiveness and interdependence from other locations.
- 2) A location where the activities of groups of humans, deliberate or unintentional, causes the occupied space to have meaning.

**Plantation**

A relatively large farm in the tropics and subtropics that grows one or two crops for export.

**Plural Society**

The presence of two or more societal groups who follow dissimilar ways of existence in the same physical area.

**Political Ecology**

A broad term that describes political activities involving the environment.

**Political Geography**

The spatial investigation of the organization and distribution of political phenomena.

**Pollution**

Physical, chemical, or biological change in the characteristics of some component of the atmosphere, hydrosphere, lithosphere, or biosphere that adversely influences the health, survival, or activities of humans or other living organisms.

**Pollution Exporting**

The direct or indirect process of sending a state's industrial pollution and waste to another country.

**Population Density**

Number of individuals of a particular species found in a specified area.

**Population Distribution**

The distribution of individuals of a particular species over a specified area.

**Population Explosion**

Sudden increase in the number of individuals found in a population because of the presence of factors that enhance reproduction.

**Population Implosion**

Sudden decrease in the number of individuals found in a population because of the presence of factors that reduce reproduction.

**Population Pyramid**

A bar graph that illustrates the age and sex frequency distribution of a human population.

**Primary Economic Activity**

Types of economic activities that deal with harvesting of natural resources for further processing.

**Primate City**

A city that is disproportionately large and functionally more complex than the other urban centers in a state.

**Prorupt State**

A state that has a compact territory and one or more territorial extensions.

**Protectorate**

A state or territory controlled by a more powerful state where the controlled political entity retains some degree of autonomy over internal affairs and is not a possession of the controlling state.

**Qanat Irrigation System**

A traditional system of irrigation that used gravity to capture and deliver groundwater to parched fields.

**Quaternary Economic Activity**

Types of economic activities that deal with research, processing and distribution, and administration.

**Rank-Size Rule**

An observed mathematical relationship between city size and rank order seen in some states.

**Refugee**

Defined under international law as a person who is outside his or her state of nationality or residence.

**Realm**

A defined geographic area of interest or study.

**Region**

An extensive territory that includes many places that generally share similar characteristics in comparison with the characteristics of places elsewhere.

**Regional Geography**

Geographical study of a select region on our planet from physical, cultural, economic, political, and/or environmental perspectives.

**Regionalism**

Situation where a minority group identifies with a particular region rather than the whole state.

**Relict Boundary**

A historic boundary that is still discernable because of some cultural landscape feature.

**Relocation Diffusion**

Form of diffusion where the phenomenon being dispersed leaves its place of origin. Compare with expansion diffusion.

**Rimland**

- 1) Coastal edge of a mainland area.
- 2) The mainland coastal edge that runs from Belize, along the rest of Central America, and then to northern South America.

**Rust Belt**

A region in the northeastern and north-central United States whose former economic activities focused on manufacturing and heavy industry. Also called the manufacturing belt.

**Scale**

- 1) A specific relative or proportional size or extent of a thing as measured through space and/or time.
- 2) General idea in geography that there are a variety of scales of investigation (local to global), that the phenomena in these scales are linked, and that processes operating at one scale often have significance at other scales.

**Secondary Economic Activity**

Types of economic activities that deal with processing of raw materials gathered from primary economic activities.

**Sector Model**

A theory in urban geography that suggests the patterns of urban land use appear as wedge-shaped segments extending outward from the central business district and positioned along major transportation routes.

**Sedentary**

Situation where groups of people settle in one place.

**Sense of Place**

The experiences, recollections, and feelings an individual can associate with a particular place and the symbolism that they connect to it.

**Sequent Occupance**

Idea that suggests cultural landscapes change over time reflecting the different cultures or technologies that continually modified it.

**Sharecropping**

Form of agriculture where farmers share their labor for the sake of efficiency.

**Shatter Belt**

A politically unstable region where influential states compete for power.

**Shifting Agriculture**

Type of agriculture where a plot of tropical forest is cleared to plant crops in a repetitive manner. Crops are viable for a couple years and then the land is abandoned. Abandoned fields then naturally return to forest cover and the nutrient stores buildup again. In 10 to 30 years, the forest can be used again to grow crops.

**Site**

The inner cultural and physical characteristics of a place.

**Situation**

The location of a place relative to the human and physical characteristics of the surrounding region.

**Sphere of Influence**

The surrounding region or countries a particular state politically influences.

**State (Country)**

An independent political entity that occupies a defined territory and is in complete sovereign control of its internal and foreign associations. Often referred to as a country.

**Stateless Nation**

A nation that does not have its own state. Also called a non-state nation.

**Subsequent Boundary**

A boundary that is established after the area has been settled. The placement of this boundary often considers cultural distinctiveness of the area.

**Subsistence Agriculture**

Type of agriculture where just enough food is grown and/or livestock raised to support the farmer and his dependents.

**Sunbelt**

Region in the United States that includes all of the southern states running from the west to east coast.

**Superimposed Boundary**

A boundary that has been placed over a pre-existing cultural pattern.

**Supranational Organizations**

A type of governing body that works to revolve the coordinated issues of more than one state.

**Sustainable Agriculture**

Form of agriculture that uses techniques to grow crops and raise livestock that conserves soil and water, uses organic fertilizers, practices biological control of pests, and minimizes the use of nonrenewable energy.

**Sustainable Development**

Forms of economic growth and human development that meet the requirements of present generations without endangering the ability of future generations of individuals to meet their own needs.

**Terraces, Agricultural**

The physical modification of slopes to produce level strips of ground on which to grow crops. This process increases the area for growing crops and reduces erosion.

**Territorial Sea**

A region of sea or ocean adjacent to a state's coastline that is viewed as sovereign territory. Most states use a 12-nautical-mile territorial sea established from the applicable coastal baseline. In the region 12 to 24 nautical miles from the coastline, states may exercise jurisdiction in terms of customs, economic, health, and

immigration matters. Together these two regions make up the contiguous zone.

**Territoriality**

A deep emotional attachment a person or groups of people can have for a particular territory. This condition can occur at varying geographic scales.

**Territory**

A geographical area on the Earth's surface over which a state has sovereign rights and that is recognized by other states.

**Tertiary Economic Activity**

Type of economic activity that deals with the selling of processed commodities in the market place.

**Theocratic State**

A state that is politically governed by religious groups.

**Toponym**

The name given to a particular place.

**Total Fertility Rate**

Estimate of the average number of children that will be born alive to a female during her lifetime if she passes through all her childbearing years (ages 15 to 44) conforming to age-specific fertility rates of a given year

**Township**

A subdivision of a land in a state into smaller equal units. In the United States, a township is 36 square miles.

**Trade**

The organized exchange of goods for other things of value. Trade can occur at different spatial levels including exchange between cities, regions, and/or states.

**Transferability**

Term that relates a commodity's value to the costs required to transport it to market. For example, diamonds have a high transferability because they require little space and are easy to transport relative to value.

**Transhumance**

The seasonal movement of livestock between summer alpine and winter lowland pastures.

**Transition Zone**

An area of gradual spatial change where the edge of two bordering realms or regions connect.



**Transmigration**

A government program that moves people from one area to another area within a state.

**Transnational Corporation**

A large, highly organized international business that has economic operations in two or more states (countries).

**Transportation Geography**

The spatial study of the patterns and processes associated with human transportation.

**Treaty of Tordesillas**

Treaty negotiated between Portugal and Spain in 1494 that divided the New World between these two dominant states. Portugal was given rights to the territories east of the 50th meridian (India) while Spain was allowed to colonize areas to the west of this boundary (Africa).

**Treaty Ports**

A seaport that is open for foreign trade according to the terms of a treaty. Formerly found in China, Korea, and Japan.

**Tribe**

A group of socially interacting humans often occupying a definable area of territory with common kinship or ancestry. Tribes generally lack the political and economic organization seen in modern states.

**Unitary State**

A state that has weak internal divisions or provinces because of a strong central government.

**Urban**

Geographical aspect belonging to or having an association with a city.

**Urban Geography**

The geographical study of the processes that shape the various aspects of cities.

**Urbanization**

The conversion of a place from being less to more urban.

**Vernacular Housing**

Style of house design that is characteristic of a particular region of the world.

**Viticulture**

Type of agriculture that involves the cultivation of grapes primarily for the production of wine.

**Voluntary Migration**

The often-permanent migration of a person because of personal choice.

**Von Thunen's Isolated State Model**

Geographical model of production first proposed by J.H. Von Thunen that suggests at the center of states is a city that is surrounded by four concentric zones: zone 1: intensive farming; zone 2: forest for timber harvesting; zone 3; less profitable field crops; and zone 4: rangeland for raising livestock.

**Wallace Line**

An imaginary line, named after British naturalist Alfred Russel Wallace, that separates the continents of Asia and Australia because of zoological differences.

**Water Stress**

A measure used to assess whether an area may have or will have acute water supply problems. This measure is based on per capita consumption and supply.

**World Bank**

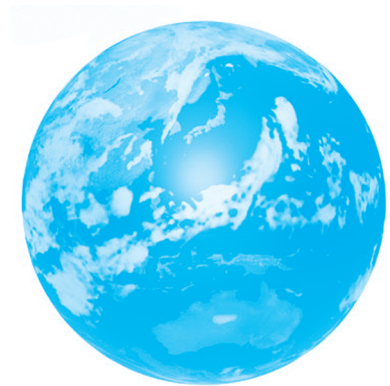
An international organization founded in 1945 to do away with poverty in developing countries. To achieve this goal, the World Bank provides developing countries with loans, grants, and technical assistance to reach this goal.

**World Trade Organization**

An international organization created in 1995 to oversee trade agreements between its member states.

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## Appendix A: World Rankings

### Rankings: Area total (All Descending)

Rank	Country	Value / Unit	
1.	Russia	17,075,200.00	sq km
2.	Canada	9,984,670.00	sq km
3.	United States	9,629,091.00	sq km
4.	China	9,596,960.00	sq km
5.	Brazil	8,511,965.00	sq km
6.	Australia	7,686,850.00	sq km
7.	India	3,287,590.00	sq km
8.	Argentina	2,766,890.00	sq km
9.	Kazakhstan	2,717,300.00	sq km
10.	Sudan	2,505,810.00	sq km
11.	Algeria	2,381,740.00	sq km
12.	Congo, Democratic Republic of the	2,345,410.00	sq km
13.	Greenland	2,166,086.00	sq km
14.	Mexico	1,972,550.00	sq km
15.	Saudi Arabia	1,960,582.00	sq km
16.	Indonesia	1,919,440.00	sq km
17.	Libya	1,759,540.00	sq km
18.	Iran	1,648,000.00	sq km
19.	Mongolia	1,565,000.00	sq km
20.	Peru	1,285,220.00	sq km
21.	Chad	1,284,000.00	sq km
22.	Niger	1,267,000.00	sq km
23.	Angola	1,246,700.00	sq km
24.	Mali	1,240,000.00	sq km
25.	South Africa	1,219,912.00	sq km
26.	Colombia	1,138,910.00	sq km
27.	Ethiopia	1,127,127.00	sq km
28.	Bolivia	1,098,580.00	sq km
29.	Mauritania	1,030,700.00	sq km
30.	Egypt	1,001,450.00	sq km
31.	Tanzania	945,087.00	sq km
32.	Nigeria	923,768.00	sq km
33.	Venezuela	912,050.00	sq km
34.	Namibia	825,418.00	sq km
35.	Pakistan	803,940.00	sq km
36.	Mozambique	801,590.00	sq km
37.	Turkey	780,580.00	sq km
38.	Chile	756,950.00	sq km
39.	Zambia	752,614.00	sq km
40.	Myanmar	678,500.00	sq km
41.	Afghanistan	647,500.00	sq km
42.	Somalia	637,657.00	sq km
43.	Central African Republic	622,984.00	sq km
44.	Ukraine	603,700.00	sq km
45.	Botswana	600,370.00	sq km
46.	Madagascar	587,040.00	sq km
47.	Kenya	582,650.00	sq km
48.	France	547,030.00	sq km
49.	Yemen	527,970.00	sq km

50.	Thailand	514,000.00	sq km	100.	Malawi	118,480.00	sq km
51.	Spain	504,782.00	sq km	101.	Benin	112,620.00	sq km
52.	Turkmenistan	488,100.00	sq km	102.	Honduras	112,090.00	sq km
53.	Cameroon	475,440.00	sq km	103.	Liberia	111,370.00	sq km
54.	Papua New Guinea	462,840.00	sq km	104.	Bulgaria	110,910.00	sq km
55.	Sweden	449,964.00	sq km	105.	Cuba	110,860.00	sq km
56.	Uzbekistan	447,400.00	sq km	106.	Guatemala	108,890.00	sq km
57.	Morocco	446,550.00	sq km	107.	Iceland	103,000.00	sq km
58.	Iraq	437,072.00	sq km	108.	Serbia and Montenegro	102,350.00	sq km
59.	Paraguay	406,750.00	sq km	109.	Korea, South	98,480.00	sq km
60.	Zimbabwe	390,580.00	sq km	110.	Hungary	93,030.00	sq km
61.	Japan	377,835.00	sq km	111.	Portugal	92,391.00	sq km
62.	Germany	357,021.00	sq km	112.	Jordan	92,300.00	sq km
63.	Congo, Republic of the	342,000.00	sq km	113.	French Guiana	91,000.00	sq km
64.	Finland	337,030.00	sq km	114.	Azerbaijan	86,600.00	sq km
65.	Malaysia	329,750.00	sq km	115.	Austria	83,858.00	sq km
66.	Vietnam	329,560.00	sq km	116.	United Arab Emirates	82,880.00	sq km
67.	Norway	324,220.00	sq km	117.	Czech Republic	78,866.00	sq km
68.	Cote d'Ivoire	322,460.00	sq km	118.	Panama	78,200.00	sq km
69.	Poland	312,685.00	sq km	119.	Sierra Leone	71,740.00	sq km
70.	Italy	301,230.00	sq km	120.	Ireland	70,280.00	sq km
71.	Philippines	300,000.00	sq km	121.	Georgia	69,700.00	sq km
72.	Ecuador	283,560.00	sq km	122.	Sri Lanka	65,610.00	sq km
73.	Burkina Faso	274,200.00	sq km	123.	Lithuania	65,200.00	sq km
74.	New Zealand	268,680.00	sq km	124.	Latvia	64,589.00	sq km
75.	Gabon	267,667.00	sq km	125.	Togo	56,785.00	sq km
76.	Western Sahara	266,000.00	sq km	126.	Croatia	56,542.00	sq km
77.	Guinea	245,857.00	sq km	127.	Bosnia and Herzegovina	51,129.00	sq km
78.	United Kingdom	244,820.00	sq km	128.	Costa Rica	51,100.00	sq km
79.	Ghana	239,460.00	sq km	129.	Slovakia	48,845.00	sq km
80.	Romania	237,500.00	sq km	130.	Dominican Republic	48,730.00	sq km
81.	Laos	236,800.00	sq km	131.	Bhutan	47,000.00	sq km
82.	Uganda	236,040.00	sq km	132.	Estonia	45,226.00	sq km
83.	Guyana	214,970.00	sq km	133.	Denmark	43,094.00	sq km
84.	Oman	212,460.00	sq km	134.	Netherlands	41,526.00	sq km
85.	Belarus	207,600.00	sq km	135.	Switzerland	41,290.00	sq km
86.	Kyrgyzstan	198,500.00	sq km	136.	Guinea-Bissau	36,120.00	sq km
87.	Senegal	196,190.00	sq km	137.	Taiwan	35,980.00	sq km
88.	Syria	185,180.00	sq km	138.	Moldova	33,843.00	sq km
89.	Cambodia	181,040.00	sq km	139.	Belgium	30,510.00	sq km
90.	Uruguay	176,220.00	sq km	140.	Lesotho	30,355.00	sq km
91.	Tunisia	163,610.00	sq km	141.	Armenia	29,800.00	sq km
92.	Suriname	163,270.00	sq km	142.	Albania	28,748.00	sq km
93.	Bangladesh	144,000.00	sq km	143.	Solomon Islands	28,450.00	sq km
94.	Tajikistan	143,100.00	sq km	144.	Equatorial Guinea	28,051.00	sq km
95.	Nepal	140,800.00	sq km	145.	Burundi	27,830.00	sq km
96.	Greece	131,940.00	sq km	146.	Haiti	27,750.00	sq km
97.	Nicaragua	129,494.00	sq km	147.	Rwanda	26,338.00	sq km
98.	Eritrea	121,320.00	sq km	148.	Macedonia, FYROM	25,333.00	sq km
99.	Korea, North	120,540.00	sq km				



149.	Djibouti	23,000.00	sq km	195.	Grenada	344.00	sq km
150.	Belize	22,966.00	sq km	196.	Malta	316.00	sq km
151.	El Salvador	21,040.00	sq km	197.	Maldives	300.00	sq km
152.	Israel	20,770.00	sq km	198.	Cayman Islands	262.00	sq km
153.	Slovenia	20,273.00	sq km	199.	Saint Kitts and Nevis	261.00	sq km
154.	New Caledonia	19,060.00	sq km	200.	Niue	260.00	sq km
155.	Fiji	18,270.00	sq km	201.	American Samoa	199.00	sq km
156.	Kuwait	17,820.00	sq km	202.	Aruba	193.00	sq km
157.	Swaziland	17,363.00	sq km	203.	Marshall Islands	181.30	sq km
158.	East Timor	15,007.00	sq km	204.	Liechtenstein	160.00	sq km
159.	Bahamas, The	13,940.00	sq km	205.	British Virgin Islands	153.00	sq km
160.	Vanuatu	12,200.00	sq km	206.	Anguilla	102.00	sq km
161.	Falkland Islands (Islas Malvinas)	12,173.00	sq km	207.	San Marino	61.20	sq km
162.	Qatar	11,437.00	sq km	208.	Bermuda	53.30	sq km
163.	Gambia, The	11,300.00	sq km	209.	Tuvalu	26.00	sq km
164.	Jamaica	10,991.00	sq km	210.	Macau	25.40	sq km
165.	Lebanon	10,400.00	sq km	211.	Nauru	21.00	sq km
166.	Cyprus	9,250.00	sq km	212.	Tokelau	10.00	sq km
167.	Puerto Rico	9,104.00	sq km	213.	Monaco	1.95	sq km
168.	Brunei	5,770.00	sq km	214.	Holy See (Vatican City)	0.44	sq km
169.	Trinidad and Tobago	5,128.00	sq km	<b>Rankings: Area land (All Descending)</b>			
170.	French Polynesia	4,167.00	sq km				
171.	Cape Verde	4,033.00	sq km	Rank	Country	Value / Unit	
172.	Samoa	2,944.00	sq km	1.	Russia	16,995,800.00	sq km
173.	Luxembourg	2,586.00	sq km	2.	China	9,326,410.00	sq km
174.	Reunion	2,517.00	sq km	3.	United States	9,158,960.00	sq km
175.	Comoros	2,170.00	sq km	4.	Canada	9,093,507.00	sq km
176.	Mauritius	2,040.00	sq km	5.	Brazil	8,456,510.00	sq km
177.	Hong Kong	1,092.00	sq km	6.	Australia	7,617,930.00	sq km
178.	Sao Tome and Principe	1,001.00	sq km	7.	India	2,973,190.00	sq km
179.	Netherlands Antilles	960.00	sq km	8.	Argentina	2,736,690.00	sq km
180.	Kiribati	811.00	sq km	9.	Kazakhstan	2,669,800.00	sq km
181.	Dominica	754.00	sq km	10.	Algeria	2,381,740.00	sq km
182.	Tonga	748.00	sq km	11.	Sudan	2,376,000.00	sq km
183.	Micronesia, Federated States of	702.00	sq km	12.	Congo, Democratic Republic of the	2,267,600.00	sq km
184.	Singapore	692.70	sq km	13.	Greenland	2,166,086.00	sq km
185.	Bahrain	665.00	sq km	14.	Saudi Arabia	1,960,582.00	sq km
186.	Saint Lucia	616.00	sq km	15.	Mexico	1,923,040.00	sq km
187.	Andorra	468.00	sq km	16.	Indonesia	1,826,440.00	sq km
188.	Palau	458.00	sq km	17.	Libya	1,759,540.00	sq km
189.	Seychelles	455.00	sq km	18.	Iran	1,636,000.00	sq km
190.	Antigua and Barbuda	443.00	sq km	19.	Mongolia	1,555,400.00	sq km
191.	Barbados	431.00	sq km	20.	Peru	1,280,000.00	sq km
192.	Saint Helena	410.00	sq km	21.	Niger	1,266,700.00	sq km
193.	Saint Vincent and the Grenadines	389.00	sq km	22.	Chad	1,259,200.00	sq km
194.	Virgin Islands	352.00	sq km	23.	Angola	1,246,700.00	sq km
				24.	Mali	1,220,000.00	sq km

25.	South Africa	1,219,912.00	sq km	74.	Western Sahara	266,000.00	sq km
26.	Ethiopia	1,119,683.00	sq km	75.	Gabon	257,667.00	sq km
27.	Bolivia	1,084,390.00	sq km	76.	Guinea	245,857.00	sq km
28.	Colombia	1,038,700.00	sq km	77.	United Kingdom	241,590.00	sq km
29.	Mauritania	1,030,400.00	sq km	78.	Ghana	230,940.00	sq km
30.	Egypt	995,450.00	sq km	79.	Laos	230,800.00	sq km
31.	Nigeria	910,768.00	sq km	80.	Romania	230,340.00	sq km
32.	Tanzania	886,037.00	sq km	81.	Oman	212,460.00	sq km
33.	Venezuela	882,050.00	sq km	82.	Belarus	207,600.00	sq km
34.	Namibia	825,418.00	sq km	83.	Uganda	199,710.00	sq km
35.	Mozambique	784,090.00	sq km	84.	Guyana	196,850.00	sq km
36.	Pakistan	778,720.00	sq km	85.	Senegal	192,000.00	sq km
37.	Turkey	770,760.00	sq km	86.	Kyrgyzstan	191,300.00	sq km
38.	Chile	748,800.00	sq km	87.	Syria	184,050.00	sq km
39.	Zambia	740,724.00	sq km	88.	Cambodia	176,520.00	sq km
40.	Burma	657,740.00	sq km	89.	Uruguay	173,620.00	sq km
41.	Afghanistan	647,500.00	sq km	90.	Suriname	161,470.00	sq km
42.	Somalia	627,337.00	sq km	91.	Tunisia	155,360.00	sq km
43.	Central African Republic	622,984.00	sq km	92.	Tajikistan	142,700.00	sq km
44.	Ukraine	603,700.00	sq km	93.	Nepal	136,800.00	sq km
45.	Botswana	585,370.00	sq km	94.	Bangladesh	133,910.00	sq km
46.	Madagascar	581,540.00	sq km	95.	Greece	130,800.00	sq km
47.	Kenya	569,250.00	sq km	96.	Eritrea	121,320.00	sq km
48.	France	545,630.00	sq km	97.	Korea, North	120,410.00	sq km
49.	Yemen	527,970.00	sq km	98.	Nicaragua	120,254.00	sq km
50.	Thailand	511,770.00	sq km	99.	Honduras	111,890.00	sq km
51.	Spain	499,542.00	sq km	100.	Cuba	110,860.00	sq km
52.	Turkmenistan	488,100.00	sq km	101.	Benin	110,620.00	sq km
53.	Cameroon	469,440.00	sq km	102.	Bulgaria	110,550.00	sq km
54.	Papua New Guinea	452,860.00	sq km	103.	Guatemala	108,430.00	sq km
55.	Morocco	446,300.00	sq km	104.	Serbia and Montenegro	102,136.00	sq km
56.	Iraq	432,162.00	sq km	105.	Iceland	100,250.00	sq km
57.	Uzbekistan	425,400.00	sq km	106.	Korea, South	98,190.00	sq km
58.	Sweden	410,934.00	sq km	107.	Liberia	96,320.00	sq km
59.	Paraguay	397,300.00	sq km	108.	Malawi	94,080.00	sq km
60.	Zimbabwe	386,670.00	sq km	109.	Hungary	92,340.00	sq km
61.	Japan	374,744.00	sq km	110.	Jordan	91,971.00	sq km
62.	Germany	349,223.00	sq km	111.	Portugal	91,951.00	sq km
63.	Congo, Republic of the	341,500.00	sq km	112.	French Guiana	89,150.00	sq km
64.	Malaysia	328,550.00	sq km	113.	Azerbaijan	86,100.00	sq km
65.	Vietnam	325,360.00	sq km	114.	United Arab Emirates	82,880.00	sq km
66.	Cote d'Ivoire	318,000.00	sq km	115.	Austria	82,738.00	sq km
67.	Norway	307,860.00	sq km	116.	Czech Republic	77,276.00	sq km
68.	Finland	305,470.00	sq km	117.	Panama	75,990.00	sq km
69.	Poland	304,465.00	sq km	118.	Sierra Leone	71,620.00	sq km
70.	Philippines	298,170.00	sq km	119.	Georgia	69,700.00	sq km
71.	Italy	294,020.00	sq km	120.	Ireland	68,890.00	sq km
72.	Ecuador	276,840.00	sq km	121.	Sri Lanka	64,740.00	sq km
73.	Burkina Faso	273,800.00	sq km	122.	Latvia	63,589.00	sq km
				123.	Croatia	56,414.00	sq km

124.	Togo	54,385.00	sq km	173.	Mauritius	2,030.00	sq km
125.	Bosnia and Herzegovina	51,129.00	sq km	174.	Hong Kong	1,042.00	sq km
126.	Costa Rica	50,660.00	sq km	175.	Sao Tome and Principe	1,001.00	sq km
127.	Slovakia	48,800.00	sq km	176.	Netherlands Antilles	960.00	sq km
128.	Dominican Republic	48,380.00	sq km	177.	Kiribati	811.00	sq km
129.	Bhutan	47,000.00	sq km	178.	Dominica	754.00	sq km
130.	Estonia	43,211.00	sq km	179.	Tonga	718.00	sq km
131.	Denmark	42,394.00	sq km	180.	Micronesia, Federated States of	702.00	sq km
132.	Switzerland	39,770.00	sq km	181.	Singapore	682.70	sq km
133.	Netherlands	33,883.00	sq km	182.	Bahrain	665.00	sq km
134.	Moldova	33,371.00	sq km	183.	Saint Lucia	606.00	sq km
135.	Taiwan	32,260.00	sq km	184.	Andorra	468.00	sq km
136.	Lesotho	30,355.00	sq km	185.	Palau	458.00	sq km
137.	Belgium	30,230.00	sq km	186.	Seychelles	455.00	sq km
138.	Armenia	28,400.00	sq km	187.	Antigua and Barbuda	443.00	sq km
139.	Equatorial Guinea	28,051.00	sq km	188.	Barbados	431.00	sq km
140.	Guinea-Bissau	28,000.00	sq km	189.	Saint Helena	410.00	sq km
141.	Haiti	27,560.00	sq km	190.	Saint Vincent and the Grenadines	389.00	sq km
142.	Solomon Islands	27,540.00	sq km	191.	Virgin Islands	349.00	sq km
143.	Albania	27,398.00	sq km	192.	Grenada	344.00	sq km
144.	Burundi	25,650.00	sq km	193.	Malta	316.00	sq km
145.	Rwanda	24,948.00	sq km	194.	Maldives	300.00	sq km
146.	Macedonia, FYROM	24,856.00	sq km	195.	Cayman Islands	262.00	sq km
147.	Djibouti	22,980.00	sq km	196.	Saint Kitts and Nevis	261.00	sq km
148.	Belize	22,806.00	sq km	197.	Niue	260.00	sq km
149.	El Salvador	20,720.00	sq km	198.	American Samoa	199.00	sq km
150.	Israel	20,330.00	sq km	199.	Aruba	193.00	sq km
151.	Slovenia	20,151.00	sq km	200.	Marshall Islands	181.30	sq km
152.	New Caledonia	18,575.00	sq km	201.	Liechtenstein	160.00	sq km
153.	Fiji	18,270.00	sq km	202.	British Virgin Islands	153.00	sq km
154.	Kuwait	17,820.00	sq km	203.	Anguilla	102.00	sq km
155.	Swaziland	17,203.00	sq km	204.	San Marino	61.20	sq km
156.	Vanuatu	12,200.00	sq km	205.	Bermuda	53.30	sq km
157.	Falkland Islands (Islas Malvinas)	12,173.00	sq km	206.	Tuvalu	26.00	sq km
158.	Qatar	11,437.00	sq km	207.	Macau	25.40	sq km
159.	Jamaica	10,831.00	sq km	208.	Nauru	21.00	sq km
160.	Lebanon	10,230.00	sq km	209.	Tokelau	10.00	sq km
161.	Bahamas, The	10,070.00	sq km	210.	Monaco	1.95	sq km
162.	Gambia, The	10,000.00	sq km	211.	Holy See (Vatican City)	0.44	sq km
163.	Cyprus	9,240.00	sq km				
164.	Puerto Rico	8,959.00	sq km				
165.	Brunei	5,270.00	sq km				
166.	Trinidad and Tobago	5,128.00	sq km				
167.	Cape Verde	4,033.00	sq km				
168.	French Polynesia	3,660.00	sq km				
169.	Samoa	2,934.00	sq km				
170.	Luxembourg	2,586.00	sq km				
171.	Reunion	2,507.00	sq km				
172.	Comoros	2,170.00	sq km				

**Rankings: Area water  
(All Descending)**

Rank	Country	Value / Unit	
1.	Canada	891,163.00	sq km
2.	United States	470,131.00	sq km
3.	India	314,400.00	sq km
4.	China	270,550.00	sq km

5.	Sudan	129,810.00	sq km	55.	Ecuador	6,720.00	sq km
6.	Colombia	100,210.00	sq km	56.	Cameroon	6,000.00	sq km
7.	Indonesia	93,000.00	sq km		Egypt	6,000.00	sq km
8.	Russia	79,400.00	sq km		Laos	6,000.00	sq km
9.	Congo, Democratic Republic of the	77,810.00	sq km	59.	Madagascar	5,500.00	sq km
10.	Australia	68,920.00	sq km	60.	Spain	5,240.00	sq km
11.	Tanzania	59,050.00	sq km	61.	Peru	5,220.00	sq km
12.	Brazil	55,455.00	sq km	62.	Iraq	4,910.00	sq km
13.	Mexico	49,510.00	sq km	63.	Cambodia	4,520.00	sq km
14.	Kazakhstan	47,500.00	sq km	64.	Cote d'Ivoire	4,460.00	sq km
15.	Sweden	39,030.00	sq km	65.	Vietnam	4,200.00	sq km
16.	Uganda	36,330.00	sq km	66.	Senegal	4,190.00	sq km
17.	Finland	31,560.00	sq km	67.	Nepal	4,000.00	sq km
18.	Argentina	30,200.00	sq km	68.	Zimbabwe	3,910.00	sq km
19.	Venezuela	30,000.00	sq km	69.	Bahamas, The	3,870.00	sq km
20.	Pakistan	25,220.00	sq km	70.	Taiwan	3,720.00	sq km
21.	Chad	24,800.00	sq km	71.	United Kingdom	3,230.00	sq km
22.	Malawi	24,400.00	sq km	72.	Japan	3,091.00	sq km
23.	Uzbekistan	22,000.00	sq km	73.	Iceland	2,750.00	sq km
24.	Burma	20,760.00	sq km	74.	Uruguay	2,600.00	sq km
25.	Mali	20,000.00	sq km	75.	Togo	2,400.00	sq km
26.	Guyana	18,120.00	sq km	76.	Thailand	2,230.00	sq km
27.	Mozambique	17,500.00	sq km	77.	Panama	2,210.00	sq km
28.	Norway	16,360.00	sq km	78.	Burundi	2,180.00	sq km
29.	Liberia	15,050.00	sq km	79.	Estonia	2,015.00	sq km
30.	Botswana	15,000.00	sq km	80.	Benin	2,000.00	sq km
31.	Bolivia	14,190.00	sq km	81.	French Guiana	1,850.00	sq km
32.	Kenya	13,400.00	sq km	82.	Philippines	1,830.00	sq km
33.	Nigeria	13,000.00	sq km	83.	Suriname	1,800.00	sq km
34.	Iran	12,000.00	sq km	84.	Czech Republic	1,590.00	sq km
35.	Zambia	11,890.00	sq km	85.	Switzerland	1,520.00	sq km
36.	Somalia	10,320.00	sq km	86.	Armenia	1,400.00	sq km
37.	Bangladesh	10,090.00	sq km		France	1,400.00	sq km
38.	Gabon	10,000.00	sq km	88.	Ireland	1,390.00	sq km
39.	Papua New Guinea	9,980.00	sq km		Rwanda	1,390.00	sq km
40.	Turkey	9,820.00	sq km	90.	Albania	1,350.00	sq km
41.	Mongolia	9,600.00	sq km	91.	Gambia, The	1,300.00	sq km
42.	Paraguay	9,450.00	sq km	92.	Malaysia	1,200.00	sq km
43.	Nicaragua	9,240.00	sq km	93.	Greece	1,140.00	sq km
44.	Ghana	8,520.00	sq km	94.	Syria	1,130.00	sq km
45.	Tunisia	8,250.00	sq km	95.	Austria	1,120.00	sq km
46.	Poland	8,220.00	sq km	96.	Latvia	1,000.00	sq km
47.	Chile	8,150.00	sq km	97.	Solomon Islands	910.00	sq km
48.	Guinea-Bissau	8,120.00	sq km	98.	Sri Lanka	870.00	sq km
49.	Germany	7,798.00	sq km	99.	Denmark	700.00	sq km
50.	Netherlands	7,643.00	sq km	100.	Hungary	690.00	sq km
51.	Ethiopia	7,444.00	sq km	101.	French Polynesia	507.00	sq km
52.	Italy	7,210.00	sq km	102.	Azerbaijan	500.00	sq km
53.	Kyrgyzstan	7,200.00	sq km		Brunei	500.00	sq km
54.	Romania	7,160.00	sq km		Congo, Republic of the	500.00	sq km



105.	New Caledonia	485.00	sq km	Barbados	0.00	sq km
106.	Macedonia, FYROM	477.00	sq km	Belarus	0.00	sq km
107.	Moldova	472.00	sq km	Bermuda	0.00	sq km
108.	Guatemala	460.00	sq km	Bhutan	0.00	sq km
109.	Costa Rica	440.00	sq km	Bosnia and Herzegovina	0.00	sq km
	Israel	440.00	sq km	British Virgin Islands	0.00	sq km
	Portugal	440.00	sq km	Cape Verde	0.00	sq km
112.	Burkina Faso	400.00	sq km	Cayman Islands	0.00	sq km
	Tajikistan	400.00	sq km	Central African Republic	0.00	sq km
114.	Bulgaria	360.00	sq km	Comoros	0.00	sq km
115.	Dominican Republic	350.00	sq km	Cuba	0.00	sq km
116.	Jordan	329.00	sq km	Dominica	0.00	sq km
117.	El Salvador	320.00	sq km	Equatorial Guinea	0.00	sq km
118.	Mauritania	300.00	sq km	Eritrea	0.00	sq km
	Niger	300.00	sq km	Falkland Islands (Islas Malvinas)	0.00	sq km
120.	Korea, South	290.00	sq km	Fiji	0.00	sq km
121.	Belgium	280.00	sq km	Georgia	0.00	sq km
122.	Morocco	250.00	sq km	Grenada	0.00	sq km
123.	Serbia and Montenegro	214.00	sq km	Guinea	0.00	sq km
	Honduras	200.00	sq km	Holy See (Vatican City)	0.00	sq km
124.	Haiti	190.00	sq km	Kiribati	0.00	sq km
125.	Lebanon	170.00	sq km	Kuwait	0.00	sq km
126.	Belize	160.00	sq km	Lesotho	0.00	sq km
	Jamaica	160.00	sq km	Libya	0.00	sq km
	Swaziland	160.00	sq km	Liechtenstein	0.00	sq km
130.	Puerto Rico	145.00	sq km	Luxembourg	0.00	sq km
131.	Korea, North	130.00	sq km	Macau	0.00	sq km
132.	Croatia	128.00	sq km	Maldives	0.00	sq km
133.	Slovenia	122.00	sq km	Malta	0.00	sq km
134.	Sierra Leone	120.00	sq km	Marshall Islands	0.00	sq km
135.	Hong Kong	50.00	sq km	Micronesia, Federated States of	0.00	sq km
136.	Slovakia	45.00	sq km	Monaco	0.00	sq km
137.	Tonga	30.00	sq km	Namibia	0.00	sq km
138.	Djibouti	20.00	sq km	Nauru	0.00	sq km
139.	Cyprus	10.00	sq km	Netherlands Antilles	0.00	sq km
	Mauritius	10.00	sq km	Niue	0.00	sq km
	Reunion	10.00	sq km	Oman	0.00	sq km
	Saint Lucia	10.00	sq km	Palau	0.00	sq km
	Samoa	10.00	sq km	Qatar	0.00	sq km
	Singapore	10.00	sq km	Saint Helena	0.00	sq km
145.	Virgin Islands	3.00	sq km	Saint Kitts and Nevis	0.00	sq km
146.	Afghanistan	0.00	sq km	San Marino	0.00	sq km
	Algeria	0.00	sq km	Sao Tome and Principe	0.00	sq km
	American Samoa	0.00	sq km	Saudi Arabia	0.00	sq km
	Andorra	0.00	sq km	Seychelles	0.00	sq km
	Angola	0.00	sq km			
	Anguilla	0.00	sq km			
	Antigua and Barbuda	0.00	sq km			
	Aruba	0.00	sq km			
	Bahrain	0.00	sq km			

South Africa	0.00	sq km
Tokelau	0.00	sq km
Trinidad and Tobago	0.00	sq km
Turkmenistan	0.00	sq km
Tuvalu	0.00	sq km
Ukraine	0.00	sq km
United Arab Emirates	0.00	sq km
Vanuatu	0.00	sq km
Western Sahara	0.00	sq km
Yemen	0.00	sq km

### Rankings: Land boundaries (All Descending)

Rank	Country	Value / Unit	
1.	China	22,147.34	km
2.	Russia	19,990.00	km
3.	Brazil	14,691.00	km
4.	India	14,103.00	km
5.	United States	12,034.00	km
6.	Kazakhstan	12,012.00	km
7.	Congo, Democratic Republic of the	10,730.00	km
8.	Argentina	9,665.00	km
9.	Canada	8,893.00	km
10.	Mongolia	8,162.00	km
11.	Sudan	7,687.00	km
12.	Mali	7,243.00	km
13.	Pakistan	6,774.00	km
14.	Bolivia	6,743.00	km
15.	Algeria	6,343.00	km
16.	Uzbekistan	6,221.00	km
17.	Chile	6,171.00	km
18.	Colombia	6,004.00	km
19.	Chad	5,968.00	km
20.	Burma	5,876.00	km
21.	Niger	5,697.00	km
22.	Zambia	5,664.00	km
23.	Peru	5,536.00	km
24.	Afghanistan	5,529.00	km
25.	Congo, Republic of the	5,504.00	km
26.	Iran	5,440.00	km
27.	Ethiopia	5,328.00	km
28.	Central African Republic	5,203.00	km
29.	Angola	5,198.00	km
30.	Laos	5,083.00	km
31.	Mauritania	5,074.00	km
32.	Venezuela	4,993.00	km
33.	Thailand	4,863.00	km

34.	South Africa	4,862.00	km
35.	Ukraine	4,663.00	km
36.	Vietnam	4,639.00	km
37.	Cameroon	4,591.00	km
38.	Mozambique	4,571.00	km
39.	Saudi Arabia	4,431.00	km
40.	Mexico	4,353.00	km
41.	Libya	4,348.00	km
42.	Bangladesh	4,246.00	km
43.	Nigeria	4,047.00	km
44.	Botswana	4,013.00	km
45.	Namibia	3,936.00	km
46.	Paraguay	3,920.00	km
47.	Kyrgyzstan	3,878.00	km
48.	Tanzania	3,861.00	km
49.	Turkmenistan	3,736.00	km
50.	Tajikistan	3,651.00	km
51.	Iraq	3,650.00	km
52.	Germany	3,621.00	km
53.	Kenya	3,477.00	km
54.	Guinea	3,399.00	km
55.	Burkina Faso	3,193.00	km
56.	Cote d'Ivoire	3,110.00	km
57.	Zimbabwe	3,066.00	km
58.	Nepal	2,926.00	km
59.	Belarus	2,900.00	km
60.	France	2,889.00	km
61.	Malawi	2,881.00	km
62.	Indonesia	2,830.00	km
63.	Poland	2,788.00	km
64.	Uganda	2,698.00	km
65.	Malaysia	2,669.00	km
66.	Egypt	2,665.00	km
67.	Turkey	2,648.00	km
68.	Senegal	2,640.00	km
69.	Finland	2,628.00	km
70.	Cambodia	2,572.00	km
71.	Austria	2,562.00	km
72.	Gabon	2,551.00	km
73.	Norway	2,544.00	km
74.	Romania	2,508.00	km
75.	Guyana	2,462.00	km
76.	Somalia	2,340.00	km
77.	Syria	2,253.00	km
78.	Serbia and Montenegro	2,246.00	km
79.	Sweden	2,205.00	km
80.	Croatia	2,197.00	km
81.	Hungary	2,171.00	km
82.	Ghana	2,094.00	km
83.	Western Sahara	2,046.00	km

84.	Morocco	2,017.90	km	134.	El Salvador	545.00	km
85.	Azerbaijan	2,013.00	km	135.	Equatorial Guinea	539.00	km
86.	Ecuador	2,010.00	km	136.	Swaziland	535.00	km
87.	Benin	1,989.00	km	137.	Belize	516.00	km
88.	Italy	1,932.20	km		Djibouti	516.00	km
89.	Spain	1,917.80	km	139.	Kuwait	462.00	km
90.	Czech Republic	1,881.00	km	140.	Lebanon	454.00	km
91.	Switzerland	1,852.00	km	141.	Brunei	381.00	km
92.	Bulgaria	1,808.00	km	142.	Dominican Republic	360.00	km
93.	Yemen	1,746.00	km		Haiti	360.00	km
94.	Suriname	1,707.00	km		Ireland	360.00	km
95.	Guatemala	1,687.00	km		United Kingdom	360.00	km
96.	Korea, North	1,673.00	km	146.	Luxembourg	359.00	km
97.	Togo	1,647.00	km	147.	Korea, South	238.00	km
98.	Jordan	1,635.00	km	148.	East Timor	228.00	km
99.	Eritrea	1,626.00	km	149.	Andorra	120.30	km
100.	Liberia	1,585.00	km	150.	Liechtenstein	76.00	km
101.	Uruguay	1,564.00	km	151.	Denmark	68.00	km
102.	Slovakia	1,524.00	km	152.	Qatar	60.00	km
103.	Honduras	1,520.00	km	153.	San Marino	39.00	km
104.	Georgia	1,461.00	km	154.	Hong Kong	30.00	km
105.	Bosnia and Herzegovina	1,459.00	km	155.	Cuba	29.00	km
		1,424.00	km	156.	Netherlands Antilles	10.20	km
106.	Tunisia	1,424.00	km	157.	Monaco	4.40	km
107.	Moldova	1,389.00	km	158.	Holy See (Vatican City)	3.20	km
108.	Belgium	1,385.00	km			0.34	km
109.	Oman	1,374.00	km	159.	Macau	0.34	km
110.	Slovenia	1,334.00	km	160.	American Samoa	0.00	km
111.	Lithuania	1,273.00	km		Anguilla	0.00	km
112.	Armenia	1,254.00	km		Antigua and Barbuda	0.00	km
113.	Nicaragua	1,231.00	km		Aruba	0.00	km
114.	Greece	1,228.00	km		Australia	0.00	km
115.	Portugal	1,214.00	km		Bahamas, The	0.00	km
116.	French Guiana	1,183.00	km		Bahrain	0.00	km
117.	Latvia	1,150.00	km		Barbados	0.00	km
118.	Bhutan	1,075.00	km		Bermuda	0.00	km
119.	Netherlands	1,027.00	km		British Virgin Islands	0.00	km
120.	Israel	1,017.00	km		Cape Verde	0.00	km
121.	Burundi	974.00	km		Cayman Islands	0.00	km
122.	Sierra Leone	958.00	km		Comoros	0.00	km
123.	Lesotho	909.00	km		Cyprus	0.00	km
124.	Rwanda	893.00	km		Dominica	0.00	km
125.	United Arab Emirates	867.00	km		Falkland Islands (Islas Malvinas)	0.00	km
126.	Papua New Guinea	820.00	km			0.00	km
127.	Macedonia, FYROM	766.00	km		Fiji	0.00	km
128.	Gambia, The	740.00	km		French Polynesia	0.00	km
129.	Guinea-Bissau	724.00	km		Greenland	0.00	km
130.	Albania	720.00	km		Grenada	0.00	km
131.	Costa Rica	639.00	km		Iceland	0.00	km
132.	Estonia	633.00	km		Jamaica	0.00	km
133.	Panama	555.00	km		Japan	0.00	km

Kiribati	0.00	km	12.	Greece	13,676.00	km
Madagascar	0.00	km	13.	United Kingdom	12,429.00	km
Maldives	0.00	km	14.	Mexico	9,330.00	km
Malta	0.00	km	15.	Italy	7,600.00	km
Marshall Islands	0.00	km	16.	Brazil	7,491.00	km
Mauritius	0.00	km	17.	Denmark	7,314.00	km
Micronesia, Federated States of	0.00	km	18.	Turkey	7,200.00	km
Nauru	0.00	km	19.	India	7,000.00	km
New Caledonia	0.00	km	20.	Chile	6,435.00	km
New Zealand	0.00	km	21.	Micronesia, Federated States of	6,112.00	km
Niue	0.00	km	22.	Croatia	5,835.00	km
Palau	0.00	km	23.	Solomon Islands	5,313.00	km
Philippines	0.00	km	24.	Papua New Guinea	5,152.00	km
Puerto Rico	0.00	km	25.	Argentina	4,989.00	km
Reunion	0.00	km	26.	Iceland	4,988.00	km
Saint Helena	0.00	km	27.	Spain	4,964.00	km
Saint Kitts and Nevis	0.00	km	28.	Madagascar	4,828.00	km
Saint Lucia	0.00	km	29.	Malaysia	4,675.00	km
Saint Vincent and the Grenadines	0.00	km	30.	Estonia	3,794.00	km
Samoa	0.00	km	31.	Cuba	3,735.00	km
Sao Tome and Principe	0.00	km	32.	Bahamas, The	3,542.00	km
Seychelles	0.00	km	33.	Vietnam	3,444.00	km
Singapore	0.00	km	34.	France	3,427.00	km
Solomon Islands	0.00	km	35.	Thailand	3,219.00	km
Sri Lanka	0.00	km	36.	Sweden	3,218.00	km
Taiwan	0.00	km	37.	Colombia	3,208.00	km
Tokelau	0.00	km	38.	Somalia	3,025.00	km
Tonga	0.00	km	39.	Venezuela	2,800.00	km
Trinidad and Tobago	0.00	km	40.	South Africa	2,798.00	km
Tuvalu	0.00	km	41.	Ukraine	2,782.00	km
Vanuatu	0.00	km	42.	Saudi Arabia	2,640.00	km
Virgin Islands	0.00	km	43.	Vanuatu	2,528.00	km
			44.	French Polynesia	2,525.00	km
			45.	Korea, North	2,495.00	km
			46.	Panama	2,490.00	km
			47.	Mozambique	2,470.00	km
			48.	Egypt	2,450.00	km
			49.	Iran	2,440.00	km
			50.	Peru	2,414.00	km
			51.	Korea, South	2,413.00	km
			52.	Germany	2,389.00	km
			53.	New Caledonia	2,254.00	km
			54.	Ecuador	2,237.00	km
			55.	Eritrea	2,234.00	km
			56.	Oman	2,092.00	km
			57.	Burma	1,930.00	km
			58.	Yemen	1,906.00	km
			59.	Morocco	1,835.00	km
			60.	Portugal	1,793.00	km
			61.	Haiti	1,771.00	km

#### Rankings: Coastline (All Descending)

Rank	Country	Value / Unit	
1.	Canada	202,080.00	km
2.	Indonesia	54,716.00	km
3.	Greenland	44,087.00	km
4.	Russia	37,653.00	km
5.	Philippines	36,289.00	km
6.	Japan	29,751.00	km
7.	Australia	25,760.00	km
8.	Norway	21,925.00	km
9.	United States	19,924.00	km
10.	New Zealand	15,134.00	km
11.	China	14,500.00	km



62.	Libya	1,770.00	km		Sierra Leone	402.00	km
63.	Angola	1,600.00	km	113.	Guatemala	400.00	km
64.	Namibia	1,572.00	km	114.	Belize	386.00	km
65.	Taiwan	1,566.30	km		Suriname	386.00	km
66.	Palau	1,519.00	km	116.	French Guiana	378.00	km
67.	Ireland	1,448.00	km	117.	Marshall Islands	370.40	km
68.	Tanzania	1,424.00	km	118.	Netherlands Antilles	364.00	km
69.	Sri Lanka	1,340.00	km	119.	Albania	362.00	km
70.	United Arab Emirates	1,318.00	km		Trinidad and Tobago	362.00	km
71.	Costa Rica	1,290.00	km	121.	Bulgaria	354.00	km
72.	Dominican Republic	1,288.00	km	122.	Guinea-Bissau	350.00	km
	Falkland Islands (Islas Malvinas)	1,288.00	km	123.	Comoros	340.00	km
74.	Tunisia	1,148.00	km	124.	Guinea	320.00	km
75.	Kiribati	1,143.00	km	125.	Djibouti	314.00	km
76.	Fiji	1,129.00	km	126.	Georgia	310.00	km
77.	Finland	1,126.00	km	127.	El Salvador	307.00	km
78.	Western Sahara	1,110.00	km	128.	Equatorial Guinea	296.00	km
79.	Pakistan	1,046.00	km	129.	Israel	273.00	km
80.	Jamaica	1,022.00	km	130.	Lebanon	225.00	km
81.	Algeria	998.00	km		Romania	225.00	km
82.	Cape Verde	965.00	km	132.	Sao Tome and Principe	209.00	km
83.	Nicaragua	910.00	km	133.	Reunion	207.00	km
84.	Gabon	885.00	km	134.	Serbia and Montenegro	199.00	km
85.	Nigeria	853.00	km		Malta	196.80	km
	Sudan	853.00	km	135.	Singapore	193.00	km
87.	Honduras	820.00	km	136.	Syria	193.00	km
88.	Mauritania	754.00	km		Virgin Islands	188.00	km
89.	Hong Kong	733.00	km	138.	Mauritius	177.00	km
90.	East Timor	706.00	km	140.	Congo, Republic of the	169.00	km
91.	Uruguay	660.00	km		Bahrain	161.00	km
92.	Cyprus	648.00	km	141.	Brunei	161.00	km
93.	Maldives	644.00	km		Cayman Islands	160.00	km
94.	Bangladesh	580.00	km	143.	Saint Lucia	158.00	km
95.	Liberia	579.00	km	144.	Antigua and Barbuda	153.00	km
96.	Qatar	563.00	km	145.	Dominica	148.00	km
97.	Ghana	539.00	km	146.	Saint Kitts and Nevis	135.00	km
98.	Kenya	536.00	km	147.	Benin	121.00	km
99.	Latvia	531.00	km	148.	Grenada	121.00	km
	Senegal	531.00	km		American Samoa	116.00	km
101.	Cote d'Ivoire	515.00	km	150.	Bermuda	103.00	km
102.	Puerto Rico	501.00	km	151.	Tokelau	101.00	km
103.	Kuwait	499.00	km	152.	Lithuania	99.00	km
104.	Poland	491.00	km	153.	Barbados	97.00	km
	Seychelles	491.00	km	154.	Saint Vincent and the Grenadines	84.00	km
106.	Guyana	459.00	km		British Virgin Islands	80.00	km
107.	Netherlands	451.00	km	155.	Gambia, The	80.00	km
108.	Cambodia	443.00	km		Aruba	68.50	km
109.	Tonga	419.00	km	156.			
110.	Samoa	403.00	km	158.			
111.	Cameroon	402.00	km				

159.	Belgium	66.00	km	Slovakia	0.00	km
160.	Niue	64.00	km	Swaziland	0.00	km
161.	Anguilla	61.00	km	Switzerland	0.00	km
162.	Saint Helena	60.00	km	Tajikistan	0.00	km
163.	Iraq	58.00	km	Turkmenistan	0.00	km
164.	Togo	56.00	km	Uganda	0.00	km
165.	Slovenia	46.60	km	Uzbekistan	0.00	km
166.	Macau	41.00	km	Zambia	0.00	km
167.	Congo, Democratic Republic of the			Zimbabwe	0.00	km
		37.00	km			
168.	Nauru	30.00	km			
169.	Jordan	26.00	km			
170.	Tuvalu	24.00	km			
171.	Bosnia and Herzegovina					
		20.00	km			
172.	Monaco	4.10	km			
173.	Afghanistan	0.00	km			
	Andorra	0.00	km			
	Armenia	0.00	km			
	Austria	0.00	km			
	Azerbaijan	0.00	km			
	Belarus	0.00	km			
	Bhutan	0.00	km			
	Bolivia	0.00	km			
	Botswana	0.00	km			
	Burkina Faso	0.00	km			
	Burundi	0.00	km			
	Central African Republic					
		0.00	km			
	Chad	0.00	km			
	Czech Republic	0.00	km			
	Ethiopia	0.00	km			
	Holy See (Vatican City)					
		0.00	km			
	Hungary	0.00	km			
	Kazakhstan	0.00	km			
	Kyrgyzstan	0.00	km			
	Laos	0.00	km			
	Lesotho	0.00	km			
	Liechtenstein	0.00	km			
	Luxembourg	0.00	km			
	Macedonia, FYROM	0.00	km			
	Malawi	0.00	km			
	Mali	0.00	km			
	Moldova	0.00	km			
	Mongolia	0.00	km			
	Nepal	0.00	km			
	Niger	0.00	km			
	Paraguay	0.00	km			
	Rwanda	0.00	km			
	San Marino	0.00	km			

### Rankings: Elevation extremes, highest point (All Descending)

Rank	Country	Value / Unit
1.	China	8,850 m
	Nepal	8,850 m
3.	Pakistan	8,611 m
4.	India	8,598 m
5.	Bhutan	7,553 m
6.	Tajikistan	7,495 m
7.	Afghanistan	7,485 m
8.	Kyrgyzstan	7,439 m
9.	Kazakhstan	6,995 m
10.	Argentina	6,960 m
11.	Chile	6,880 m
12.	Peru	6,768 m
13.	Bolivia	6,542 m
14.	Ecuador	6,267 m
15.	United States	6,194 m
16.	Canada	5,959 m
17.	Tanzania	5,895 m
18.	Myanmar	5,881 m
19.	Colombia	5,775 m
20.	Mexico	5,700 m
21.	Iran	5,671 m
22.	Russia	5,633 m
23.	Georgia	5,201 m
24.	Kenya	5,199 m
25.	Turkey	5,166 m
26.	Congo, Democratic Republic of the	
		5,110 m
	Uganda	5,110 m
28.	Indonesia	5,030 m
29.	Venezuela	5,007 m
30.	France	4,807 m
31.	Italy	4,748 m
32.	Switzerland	4,634 m
33.	Ethiopia	4,620 m
34.	Rwanda	4,519 m
35.	Papua New Guinea	4,509 m
36.	Azerbaijan	4,485 m

37.	Mongolia	4,374	m	88.	Burundi	2,670	m
38.	Uzbekistan	4,301	m	89.	Serbia and Montenegro	2,656	m
39.	Guatemala	4,211	m	90.	Slovakia	2,655	m
40.	Morocco	4,165	m	91.	Egypt	2,629	m
41.	Malaysia	4,100	m	92.	Angola	2,620	m
42.	Cameroon	4,095	m	93.	Namibia	2,606	m
43.	Armenia	4,090	m	94.	Liechtenstein	2,599	m
44.	Taiwan	3,952	m	95.	Zimbabwe	2,592	m
45.	Costa Rica	3,810	m	96.	Thailand	2,576	m
46.	Austria	3,798	m	97.	Romania	2,544	m
47.	Japan	3,776	m	98.	Sri Lanka	2,524	m
48.	Yemen	3,760	m	99.	Poland	2,499	m
49.	New Zealand	3,754	m	100.	Norway	2,469	m
50.	Spain	3,718	m	101.	Solomon Islands	2,447	m
51.	Greenland	3,700	m	102.	Nicaragua	2,438	m
52.	Iraq	3,611	m	103.	Mozambique	2,436	m
53.	Lesotho	3,482	m	104.	Nigeria	2,419	m
54.	Panama	3,475	m	105.	Somalia	2,416	m
55.	Chad	3,415	m	106.	Bosnia and Herzegovina	2,386	m
56.	South Africa	3,408	m	107.	Comoros	2,360	m
57.	Sudan	3,187	m	108.	Portugal	2,351	m
58.	Dominican Republic	3,175	m	109.	Zambia	2,301	m
59.	Vietnam	3,144	m	110.	Libya	2,267	m
60.	Turkmenistan	3,139	m	111.	Jamaica	2,256	m
61.	Saudi Arabia	3,133	m	112.	French Polynesia	2,241	m
62.	Lebanon	3,088	m	113.	Australia	2,229	m
63.	Reunion	3,069	m	114.	Iceland	2,119	m
64.	Eritrea	3,018	m	115.	Sweden	2,111	m
65.	Brazil	3,014	m	116.	Ukraine	2,061	m
66.	Equatorial Guinea	3,008	m	117.	Saint Helena	2,060	m
67.	Algeria	3,003	m	118.	Djibouti	2,028	m
68.	Malawi	3,002	m	119.	Sao Tome and Principe	2,024	m
69.	Oman	2,980	m	120.	Niger	2,022	m
70.	East Timor	2,963	m	121.	Cuba	2,005	m
	Germany	2,963	m	122.	Cyprus	1,951	m
72.	Philippines	2,954	m	123.	Korea, South	1,950	m
73.	Andorra	2,946	m	124.	Sierra Leone	1,948	m
74.	Bulgaria	2,925	m	125.	Vanuatu	1,877	m
75.	Greece	2,917	m	126.	Swaziland	1,862	m
76.	Madagascar	2,876	m	127.	Samoa	1,857	m
77.	Honduras	2,870	m	128.	Brunei	1,850	m
78.	Slovenia	2,864	m	129.	Croatia	1,830	m
79.	Guyana	2,835	m	130.	Cambodia	1,810	m
80.	Cape Verde	2,829	m	131.	Cote d'Ivoire	1,752	m
81.	Laos	2,817	m		Guinea	1,752	m
82.	Syria	2,814	m	133.	Jordan	1,734	m
83.	Albania	2,753	m	134.	New Caledonia	1,628	m
	Macedonia, FYROM	2,753	m	135.	Czech Republic	1,602	m
85.	Korea, North	2,744	m	136.	Gabon	1,575	m
86.	El Salvador	2,730	m	137.	Tunisia	1,544	m
87.	Haiti	2,680	m	138.	United Arab Emirates	1,527	m

139.	Botswana	1,489	m
140.	Dominica	1,447	m
141.	Central African Republic	1,420	m
142.	Liberia	1,380	m
143.	United Kingdom	1,343	m
144.	Puerto Rico	1,338	m
145.	Finland	1,328	m
146.	Fiji	1,324	m
147.	Saint Vincent and the Grenadines	1,234	m
148.	Bangladesh	1,230	m
	Suriname	1,230	m
150.	Israel	1,208	m
151.	Belize	1,160	m
152.	Saint Kitts and Nevis	1,156	m
153.	Mali	1,155	m
154.	Ireland	1,041	m
155.	Tonga	1,033	m
156.	Hungary	1,014	m
157.	Togo	986	m
158.	American Samoa	966	m
159.	Hong Kong	958	m
160.	Saint Lucia	950	m
161.	Trinidad and Tobago	940	m
162.	Mauritania	910	m
163.	Seychelles	905	m
164.	Congo, Republic of the	903	m
165.	Ghana	880	m
166.	Netherlands Antilles	862	m
167.	French Guiana	851	m
168.	Paraguay	842	m
169.	Grenada	840	m
170.	Mauritius	828	m
171.	Micronesia, Federated States of	791	m
172.	San Marino	755	m
173.	Burkina Faso	749	m
174.	Falkland Islands (Islas Malvinas)	705	m
175.	Belgium	694	m
176.	Benin	658	m
177.	Senegal	581	m
178.	Luxembourg	559	m
179.	British Virgin Islands	521	m
180.	Uruguay	514	m
181.	Virgin Islands	474	m
182.	Western Sahara	463	m
183.	Moldova	430	m
184.	Antigua and Barbuda	402	m
185.	Belarus	346	m
186.	Barbados	336	m

187.	Netherlands	322	m
188.	Estonia	318	m
189.	Latvia	312	m
190.	Kuwait	306	m
191.	Guinea-Bissau	300	m
192.	Lithuania	292	m
193.	Malta	253	m
194.	Palau	242	m
195.	Aruba	188	m
196.	Denmark	173	m
197.	Macau	172	m
198.	Singapore	166	m
199.	Monaco	140	m
200.	Bahrain	122	m
201.	Qatar	103	m
202.	Kiribati	81	m
203.	Bermuda	76	m
204.	Holy See (Vatican City)	75	m
205.	Niue	68	m
206.	Anguilla	65	m
207.	Bahamas, The	63	m
208.	Nauru	61	m
209.	Gambia, The	53	m
210.	Cayman Islands	43	m
211.	Marshall Islands	10	m
212.	Tokelau	5	m
	Tuvalu	5	m
214.	Maldives	2	m

**Rankings: Land use, arable land  
(All Descending)**

Rank	Country	Value / Unit
1.	Bangladesh	60.70 %
2.	Ukraine	57.10 %
3.	Denmark	55.74 %
4.	India	54.35 %
5.	Moldova	54.08 %
6.	Hungary	52.20 %
7.	Mauritius	49.26 %
8.	Poland	45.81 %
9.	Lithuania	45.46 %
10.	Togo	41.37 %
11.	Romania	40.57 %
12.	Czech Republic	40.00 %
13.	Bulgaria	39.00 %
14.	Barbados	37.21 %
15.	Serbia and Montenegro	36.34 %
16.	Comoros	34.98 %
17.	Turkey	34.53 %
18.	Germany	33.88 %



19.	France	33.30	%	70.	Israel	17.02	%
20.	Cuba	33.04	%	71.	Austria	16.89	%
21.	Thailand	32.88	%	72.	Marshall Islands	16.67	%
22.	Rwanda	32.43	%		Saint Kitts and Nevis	16.67	%
23.	Malta	31.25	%		San Marino	16.67	%
24.	Nigeria	30.96	%	75.	Jamaica	16.07	%
25.	Slovakia	30.74	%	76.	Ghana	15.82	%
26.	Burundi	29.98	%	77.	Benin	15.28	%
27.	Belarus	29.76	%	78.	Honduras	15.15	%
28.	Latvia	29.01	%	79.	Virgin Islands	15.00	%
29.	Spain	28.60	%	80.	Trinidad and Tobago	14.62	%
30.	Italy	28.07	%	81.	Burma	14.53	%
31.	Pakistan	27.81	%	82.	Korea, North	14.12	%
32.	El Salvador	27.27	%	83.	Sri Lanka	13.43	%
33.	Netherlands	26.53	%	84.	China	13.31	%
34.	Estonia	26.50	%	85.	Mexico	13.20	%
35.	United Kingdom	26.41	%		Reunion	13.20	%
36.	Syria	25.96	%	87.	Saint Helena	12.90	%
37.	Uganda	25.34	%	88.	Cameroon	12.81	%
38.	Belgium	25.00	%	89.	Guatemala	12.54	%
	Liechtenstein	25.00	%	90.	Burkina Faso	12.43	%
	Luxembourg	25.00	%	91.	Afghanistan	12.13	%
41.	Taiwan	24.00	%		Japan	12.13	%
42.	Tonga	23.61	%		South Africa	12.13	%
43.	Macedonia, FYROM	23.59	%	94.	Iraq	11.89	%
44.	Croatia	23.55	%	95.	Senegal	11.58	%
45.	Greece	22.12	%	96.	Slovenia	11.48	%
46.	Palau	21.74	%	97.	Kazakhstan	11.23	%
47.	Albania	21.09	%	98.	Georgia	11.21	%
48.	Dominican Republic	21.08	%	99.	Fiji	10.95	%
49.	Cambodia	20.96	%	100.	Uzbekistan	10.80	%
50.	Portugal	20.57	%	101.	Lesotho	10.71	%
51.	Haiti	20.32	%	102.	Guinea-Bissau	10.67	%
52.	Nepal	20.27	%	103.	Cyprus	10.61	%
53.	Nicaragua	20.24	%	104.	Switzerland	10.57	%
54.	Morocco	20.12	%	105.	Aruba	10.53	%
55.	British Virgin Islands	20.00	%	106.	Saint Vincent and the Grenadines	10.26	%
56.	Malawi	19.93	%				
57.	Gambia, The	19.50	%	107.	Iran	10.17	%
58.	Ireland	19.49	%	108.	Netherlands Antilles	10.00	%
59.	Samoa	19.43	%	109.	Ethiopia	9.90	%
60.	United States	19.32	%		Indonesia	9.90	%
61.	Azerbaijan	19.31	%	111.	Bosnia and Herzegovina	9.80	%
62.	Niue	19.23	%	112.	Swaziland	9.77	%
63.	Tunisia	18.67	%	113.	Cape Verde	9.68	%
64.	Philippines	18.45	%	114.	Cote d'Ivoire	9.28	%
65.	Antigua and Barbuda	18.18	%	115.	Argentina	9.14	%
66.	Lebanon	17.60	%	116.	Zimbabwe	8.40	%
67.	Armenia	17.52	%	117.	Russia	7.46	%
68.	Korea, South	17.44	%	118.	Uruguay	7.21	%
69.	Vietnam	17.41	%	119.	Zambia	7.08	%

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120.	Kyrgyzstan	7.04	%	169.	Vanuatu	2.46	%
121.	Kenya	7.03	%	170.	Guyana	2.44	%
	Sudan	7.03	%	171.	Angola	2.41	%
123.	Finland	6.98	%	172.	Andorra	2.22	%
124.	Australia	6.88	%		Seychelles	2.22	%
125.	Sweden	6.80	%	174.	Sao Tome and Principe	2.00	%
126.	Sierra Leone	6.76	%	175.	Liberia	1.97	%
127.	Panama	6.72	%	176.	Colombia	1.90	%
128.	Brazil	6.30	%	177.	Bolivia	1.73	%
129.	Bermuda	6.00	%	178.	Saudi Arabia	1.72	%
130.	Grenada	5.88	%	179.	Somalia	1.66	%
131.	New Zealand	5.80	%	180.	French Polynesia	1.64	%
132.	Micronesia, Federated States of				Singapore	1.64	%
		5.71	%	182.	Solomon Islands	1.50	%
133.	Ecuador	5.69	%	183.	Qatar	1.27	%
134.	Malaysia	5.54	%	184.	Gabon	1.26	%
	Paraguay	5.54	%	185.	Libya	1.03	%
136.	Tajikistan	5.41	%	186.	Iceland	1.00	%
137.	Hong Kong	5.05	%	187.	Namibia	0.99	%
138.	American Samoa	5.00	%	188.	Mongolia	0.84	%
139.	Canada	4.94	%	189.	Botswana	0.61	%
140.	Saint Lucia	4.92	%	190.	Bahamas, The	0.60	%
141.	Equatorial Guinea	4.63	%	191.	Brunei	0.57	%
142.	Costa Rica	4.41	%	192.	Congo, Republic of the	0.50	%
	Madagascar	4.41	%	193.	Mauritania	0.48	%
144.	Bahrain	4.35	%		United Arab Emirates	0.48	%
145.	Tanzania	4.24	%	195.	New Caledonia	0.38	%
146.	Dominica	4.00	%	196.	Suriname	0.37	%
147.	Mozambique	3.98	%	197.	Kuwait	0.34	%
148.	Niger	3.94	%	198.	Papua New Guinea	0.13	%
149.	Eritrea	3.87	%	199.	French Guiana	0.11	%
150.	Mali	3.77	%	200.	Oman	0.08	%
151.	Puerto Rico	3.72	%	201.	Anguilla	0.00	%
152.	Guinea	3.60	%		Cayman Islands	0.00	%
153.	Laos	3.47	%		Djibouti	0.00	%
	Turkmenistan	3.47	%		Falkland Islands (Islas Malvinas)	0.00	%
155.	Maldives	3.33	%			0.00	%
156.	Algeria	3.21	%		Greenland	0.00	%
157.	Central African Republic	3.10	%		Holy See (Vatican City)	0.00	%
158.	Venezuela	2.99	%		Kiribati	0.00	%
159.	Bhutan	2.98	%		Macau	0.00	%
160.	Congo, Democratic Republic of the				Monaco	0.00	%
		2.96	%		Nauru	0.00	%
161.	Norway	2.94	%		Tokelau	0.00	%
162.	Jordan	2.87	%		Tuvalu	0.00	%
163.	Egypt	2.85	%				
	Peru	2.85	%				
165.	Belize	2.81	%				
166.	Chad	2.78	%				
167.	Yemen	2.75	%				
168.	Chile	2.65	%				

**Rankings: Land use, permanent crops  
(All Descending)**

Rank	Country	Value / Unit
1.	Kiribati	50.68 %

2.	Micronesia, Federated States of	45.71	%	51.	Bahrain	4.35	%
3.	Tonga	43.06	%	52.	Israel	4.17	%
4.	Sao Tome and Principe	41.00	%	53.	Georgia	4.09	%
5.	Grenada	26.47	%	54.	Syria	4.08	%
6.	Samoa	23.67	%	55.	Equatorial Guinea	3.57	%
7.	Saint Lucia	22.95	%	56.	Serbia and Montenegro	3.44	%
8.	Saint Vincent and the Grenadines	17.95	%	57.	Turkey	3.36	%
9.	Comoros	17.94	%	58.	Honduras	3.13	%
10.	Malaysia	17.61	%		Malta	3.13	%
11.	Dominica	16.00	%	60.	Azerbaijan	3.04	%
12.	Sri Lanka	15.78	%		Czech Republic	3.04	%
13.	Philippines	14.76	%	62.	Mauritius	2.96	%
14.	Cote d'Ivoire	13.84	%	63.	Bosnia and Herzegovina	2.94	%
15.	Seychelles	13.33	%	64.	Nigeria	2.79	%
16.	Tunisia	12.87	%	65.	Saint Kitts and Nevis	2.78	%
17.	Burundi	12.85	%	66.	Slovenia	2.68	%
18.	Haiti	12.70	%	67.	India	2.66	%
19.	Lebanon	12.51	%	68.	Slovakia	2.64	%
20.	El Salvador	12.11	%	69.	Bangladesh	2.61	%
21.	Moldova	12.10	%	70.	Cameroon	2.58	%
22.	Rwanda	10.13	%	71.	Korea, North	2.49	%
23.	American Samoa	10.00	%	72.	Hungary	2.46	%
24.	Dominican Republic	9.92	%	73.	Guinea	2.44	%
25.	Spain	9.56	%	74.	Romania	2.40	%
26.	Italy	9.25	%	75.	Nicaragua	2.38	%
27.	Jamaica	9.23	%	76.	Barbados	2.33	%
28.	Trinidad and Tobago	9.16	%	77.	Armenia	2.30	%
29.	Uganda	8.77	%	78.	Croatia	2.24	%
30.	Greece	8.47	%	79.	France	2.11	%
31.	Portugal	7.74	%	80.	Liberia	2.08	%
32.	Niue	7.69	%		Panama	2.08	%
33.	Cuba	7.61	%	82.	Korea, South	2.05	%
34.	Ghana	7.47	%		Morocco	2.05	%
35.	Vanuatu	7.38	%	84.	Reunion	2.00	%
36.	Indonesia	7.20	%	85.	Colombia	1.96	%
37.	Thailand	7.00	%	86.	Macedonia, FYROM	1.85	%
38.	British Virgin Islands	6.67	%	87.	Togo	1.84	%
	Maldives	6.67	%	88.	Bulgaria	1.80	%
40.	New Zealand	6.44	%	89.	Guinea-Bissau	1.78	%
41.	French Polynesia	6.01	%	90.	Ukraine	1.73	%
42.	Virgin Islands	6.00	%	91.	Jordan	1.52	%
43.	Costa Rica	5.48	%	92.	Brazil	1.42	%
44.	Ecuador	5.15	%	93.	Benin	1.36	%
45.	Puerto Rico	5.07	%	94.	Papua New Guinea	1.35	%
46.	Guatemala	5.03	%	95.	Malawi	1.33	%
47.	Vietnam	4.71	%	96.	Poland	1.23	%
48.	Cyprus	4.65	%	97.	China	1.20	%
	Fiji	4.65	%	98.	Iran	1.16	%
50.	Albania	4.45	%	99.	Belize	1.10	%
					Mexico	1.10	%
				101.	Netherlands	1.03	%

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102.	Tanzania	1.02	%		Bolivia	0.21	%
103.	Hong Kong	1.01	%		Paraguay	0.21	%
	Japan	1.01	%		Yemen	0.21	%
105.	Taiwan	1.00	%	155.	Denmark	0.19	%
106.	Austria	0.99	%		Senegal	0.19	%
107.	Venezuela	0.96	%	157.	Burkina Faso	0.18	%
108.	Lithuania	0.93	%		United Kingdom	0.18	%
	Madagascar	0.93	%	159.	Libya	0.17	%
110.	Tajikistan	0.92	%	160.	Central African Republic	0.14	%
111.	Kenya	0.91	%		Turkmenistan	0.14	%
	Uzbekistan	0.91	%	162.	Congo, Republic of the	0.13	%
113.	Burma	0.90	%	163.	Russia	0.11	%
114.	Argentina	0.80	%	164.	Guyana	0.08	%
115.	Pakistan	0.79	%		Sudan	0.08	%
116.	Iraq	0.78	%	166.	Kuwait	0.06	%
	Sierra Leone	0.78	%		Saudi Arabia	0.06	%
118.	South Africa	0.77	%		Suriname	0.06	%
119.	Brunei	0.76	%	169.	Kazakhstan	0.05	%
120.	Swaziland	0.70	%	170.	Ireland	0.04	%
121.	Belarus	0.69	%		Mali	0.04	%
122.	Gabon	0.66	%		Somalia	0.04	%
123.	Ethiopia	0.65	%	173.	Australia	0.03	%
	Germany	0.65	%		French Guiana	0.03	%
125.	Solomon Islands	0.64	%		Zambia	0.03	%
126.	Cambodia	0.61	%	176.	Canada	0.02	%
	Switzerland	0.61	%		Chad	0.02	%
128.	Congo, Democratic Republic of the				Eritrea	0.02	%
		0.52	%	179.	Botswana	0.01	%
129.	Cape Verde	0.50	%		Finland	0.01	%
	Gambia, The	0.50	%		Mauritania	0.01	%
131.	Nepal	0.49	%	182.	Andorra	0.00	%
	United Arab Emirates	0.49	%		Anguilla	0.00	%
133.	Latvia	0.48	%		Antigua and Barbuda	0.00	%
134.	Egypt	0.47	%		Aruba	0.00	%
135.	Bhutan	0.43	%		Belgium	0.00	%
136.	Chile	0.42	%		Bermuda	0.00	%
137.	Angola	0.40	%		Cayman Islands	0.00	%
	Bahamas, The	0.40	%		Djibouti	0.00	%
139.	Kyrgyzstan	0.39	%		Falkland Islands (Islas Malvinas)		
140.	Peru	0.38	%			0.00	%
141.	Estonia	0.35	%		Greenland	0.00	%
142.	Zimbabwe	0.34	%		Holy See (Vatican City)	0.00	%
143.	New Caledonia	0.33	%		Iceland	0.00	%
144.	Mozambique	0.29	%		Lesotho	0.00	%
145.	Qatar	0.27	%		Liechtenstein	0.00	%
	Uruguay	0.27	%		Luxembourg	0.00	%
147.	Laos	0.23	%		Macau	0.00	%
148.	Afghanistan	0.22	%		Marshall Islands	0.00	%
	Oman	0.22	%		Monaco	0.00	%
	United States	0.22	%		Mongolia	0.00	%
151.	Algeria	0.21	%		Namibia	0.00	%



Nauru	0.00	%
Netherlands Antilles	0.00	%
Niger	0.00	%
Norway	0.00	%
Palau	0.00	%
Saint Helena	0.00	%
San Marino	0.00	%
Singapore	0.00	%
Sweden	0.00	%
Tokelau	0.00	%
Tuvalu	0.00	%
Western Sahara	0.00	%

34.	Algeria	32,277,942
35.	Canada	32,207,113
36.	Morocco	31,167,783
37.	Kenya	31,639,091
38.	Afghanistan	28,717,213
39.	Peru	27,148,000
40.	Nepal	27,070,666
41.	Uzbekistan	26,410,416
42.	Uganda	25,632,794
43.	Venezuela	25,017,737
44.	Iraq	24,683,313
45.	Saudi Arabia	24,293,844
46.	Malaysia	23,522,482
47.	Taiwan	22,603,001
48.	Korea, North	22,466,481
49.	Romania	22,355,551
50.	Ghana	20,467,747
51.	Sri Lanka	19,742,439
52.	Australia	19,731,984
53.	Yemen	19,349,881
54.	Syria	19,000,000
55.	Mozambique	17,600,000
56.	Madagascar	17,501,871
57.	Côte d'Ivoire	17,327,724
58.	Kazakhstan	16,763,795
59.	Netherlands	16,150,511
60.	Cameroon	15,456,000
61.	Chile	15,200,000
62.	Guatemala	13,909,384
63.	Burkina Faso	13,228,460
64.	Ecuador	13,212,742
65.	Cambodia	13,124,764
66.	Zimbabwe	12,671,860
67.	Angola	12,386,000
68.	Malawi	12,000,000
69.	Mali	11,626,219
70.	Cuba	11,263,429
71.	Niger	11,058,590
72.	Greece	10,665,989
73.	Serbia and Montenegro	10,655,774
74.	Senegal	10,580,307
75.	Belarus	10,310,520
76.	Zambia	10,307,333
77.	Belgium	10,289,088
78.	Czech Republic	10,249,216
79.	Portugal	10,102,022
80.	Hungary	10,045,407
81.	Tunisia	9,924,742
82.	Chad	9,253,493
83.	Guinea	9,030,220
84.	Sweden	8,878,085

### Rankings: Population (All Descending)

Rank	Country	Value / Unit
1.	China	1,298,847,624
2.	India	1,049,700,118
3.	United States	290,342,554
4.	Indonesia	238,452,952
5.	Brazil	184,101,109
6.	Pakistan	150,000,000
7.	Russia	144,526,278
8.	Bangladesh	138,448,210
9.	Nigeria	133,881,703
10.	Japan	127,214,499
11.	Mexico	104,959,594
12.	Philippines	84,619,974
13.	Germany	82,398,326
14.	Vietnam	81,624,716
15.	Egypt	70,712,345
16.	Iran	68,278,826
17.	Turkey	68,893,918
18.	Ethiopia	66,557,553
19.	Thailand	64,265,276
20.	France	60,180,529
21.	United Kingdom	60,094,648
22.	Italy	57,000,000
23.	Congo, Democratic Republic of the	56,625,039
24.	Korea, South	48,289,037
25.	Ukraine	47,732,079
26.	South Africa	44,800,000
27.	Burma	42,510,537
28.	Colombia	42,310,774
29.	Spain	42,217,064
30.	Argentina	39,144,753
31.	Poland	38,622,660
32.	Sudan	37,000,000
33.	Tanzania	33,000,000

85.	Dominican Republic	8,715,602	136.	Mongolia	2,712,315
86.	Bolivia	8,586,443	137.	Jamaica	2,695,867
87.	Austria	8,188,207	138.	United Arab Emirates	2,484,818
88.	Somalia	8,025,190	139.	Latvia	2,348,784
89.	Azerbaijan	7,830,764	140.	Kuwait	2,183,161
90.	Rwanda	7,810,056	141.	Bhutan	2,139,549
91.	Bulgaria	7,537,929	142.	Macedonia, FYROM	2,063,122
92.	Haiti	7,527,817	143.	Slovenia	1,935,677
93.	Hong Kong	7,394,170	144.	Namibia	1,927,447
94.	Switzerland	7,318,638	145.	Lesotho	1,861,959
95.	Benin	7,041,490	146.	Botswana	1,573,267
96.	Tajikistan	6,863,752	147.	Gambia, The	1,501,050
97.	Honduras	6,669,789	148.	Estonia	1,408,556
98.	El Salvador	6,470,379	149.	Guinea-Bissau	1,360,827
99.	Israel	6,116,533	150.	Gabon	1,321,560
100.	Burundi	6,096,156	151.	Mauritius	1,210,447
101.	Paraguay	6,036,900	152.	Swaziland	1,161,219
102.	Laos	5,921,545	153.	Trinidad and Tobago	1,104,209
103.	Sierra Leone	5,732,681	154.	East Timor	997,853
104.	Libya	5,499,074	155.	Fiji	868,531
105.	Jordan	5,460,265	156.	Qatar	817,052
106.	Slovakia	5,430,033	157.	Cyprus	771,657
107.	Togo	5,429,299	158.	Reunion	755,171
108.	Denmark	5,384,384	159.	Guyana	702,100
109.	Papua New Guinea	5,295,816	160.	Bahrain	667,238
110.	Finland	5,190,785	161.	Comoros	632,948
111.	Nicaragua	5,128,517	162.	Equatorial Guinea	510,473
112.	Georgia	4,934,413	163.	Solomon Islands	509,190
113.	Kyrgyzstan	4,892,808	164.	Macau	469,903
114.	Turkmenistan	4,775,544	165.	Djibouti	457,130
115.	Singapore	4,608,595	166.	Luxembourg	454,157
116.	Norway	4,546,123	167.	Suriname	435,449
117.	Moldova	4,439,502	168.	Cape Verde	412,137
118.	Croatia	4,422,248	169.	Malta	400,420
119.	Eritrea	4,362,254	170.	Brunei	358,098
120.	Bosnia and Herzegovina	3,989,018	171.	Maldives	329,684
121.	New Zealand	3,951,307	172.	Bahamas, The	297,477
122.	Ireland	3,924,140	173.	Iceland	280,798
123.	Costa Rica	3,896,092	174.	Barbados	277,264
124.	Puerto Rico	3,885,877	175.	Belize	266,440
125.	Lebanon	3,727,703	176.	French Polynesia	262,125
126.	Central African Republic	3,683,538	177.	Western Sahara	261,794
127.	Lithuania	3,592,561	178.	Netherlands Antilles	216,226
128.	Albania	3,582,205	179.	New Caledonia	210,798
129.	Uruguay	3,413,329	180.	Vanuatu	199,414
130.	Armenia	3,326,448	181.	French Guiana	186,917
131.	Liberia	3,317,176	182.	Samoa	178,173
132.	Panama	2,960,784	183.	Sao Tome and Principe	175,883
133.	Congo, Republic of the	2,954,258	184.	Saint Lucia	162,157
134.	Mauritania	2,912,584	185.	Virgin Islands	124,778
135.	Oman	2,807,125			

186.	Saint Vincent and the Grenadines	116,812	14.	Benin	2.95	%
187.	Micronesia, Federated States of	108,143	15.	Sierra Leone	2.94	%
188.	Tonga	108,141	16.	Maldives	2.91	%
189.	Kiribati	98,549		Mauritania	2.91	%
190.	Grenada	89,258	18.	Congo, Democratic Republic of the	2.90	%
191.	Seychelles	80,469	19.	Qatar	2.87	%
192.	Aruba	70,844	20.	Solomon Islands	2.83	%
193.	American Samoa	70,260	21.	Mali	2.82	%
194.	Dominica	69,655	22.	Cayman Islands	2.79	%
195.	Andorra	69,150	23.	Iraq	2.78	%
196.	Antigua and Barbuda	67,897		Jordan	2.78	%
197.	Bermuda	64,482	25.	Niger	2.71	%
198.	Marshall Islands	56,429		Sudan	2.71	%
199.	Greenland	56,385	27.	Guatemala	2.66	%
200.	Cayman Islands	41,934	28.	Burkina Faso	2.60	%
201.	Saint Kitts and Nevis	38,763	29.	Senegal	2.56	%
202.	Liechtenstein	33,145	30.	Gabon	2.54	%
203.	Monaco	32,130		Paraguay	2.54	%
204.	San Marino	28,119	32.	Nigeria	2.53	%
205.	British Virgin Islands	21,730	33.	Laos	2.45	%
206.	Palau	19,717		Syria	2.45	%
207.	Anguilla	12,738	35.	Belize	2.44	%
208.	Nauru	12,570		Equatorial Guinea	2.44	%
209.	Tuvalu	11,305		Falkland Islands (Islas Malvinas)	2.44	%
210.	Saint Helena	7,367	38.	French Guiana	2.40	%
211.	Falkland Islands (Islas Malvinas)	2,967	39.	Libya	2.39	%
212.	Niue	2,145	40.	Guinea	2.37	%
213.	Tokelau	1,418		Togo	2.37	%
214.	Holy See (Vatican City)	911	42.	Papua New Guinea	2.34	%
<b>Rankings: Population growth rate</b>			43.	Honduras	2.32	%
<b>(All Descending)</b>			44.	Marshall Islands	2.30	%
Rank	Country	Value / Unit	45.	Kiribati	2.26	%
1.	Somalia	3.43 %		Nepal	2.26	%
2.	Singapore	3.42 %	47.	American Samoa	2.22	%
	Yemen	3.42 %	48.	Anguilla	2.21	%
4.	Afghanistan	3.38 %		Malawi	2.21	%
	Oman	3.38 %	50.	Burundi	2.18	%
6.	Kuwait	3.34 %	51.	Cote d'Ivoire	2.15	%
7.	Saudi Arabia	3.27 %	52.	Bhutan	2.14	%
8.	Sao Tome and Principe	3.18 %	53.	Djibouti	2.13	%
9.	Chad	3.07 %		East Timor	2.13	%
10.	Gambia, The	3.03 %		Tajikistan	2.13	%
	Madagascar	3.03 %	56.	British Virgin Islands	2.10	%
12.	Comoros	2.96 %	57.	Bangladesh	2.06	%
	Uganda	2.96 %	58.	Nicaragua	2.03	%
			59.	Cameroon	2.02	%
				Guinea-Bissau	2.02	%
			61.	Pakistan	2.01	%
			62.	Brunei	2.00	%

## 1050 Appendix A: World Rankings

63.	Angola	1.97	%	114.	Saint Lucia	1.25	%
64.	Ethiopia	1.96	%	115.	Luxembourg	1.23	%
65.	Philippines	1.92	%	116.	Hong Kong	1.22	%
66.	Ecuador	1.91	%	117.	Turkey	1.16	%
67.	Nauru	1.90	%	118.	Brazil	1.15	%
	Tonga	1.90	%	119.	New Zealand	1.09	%
69.	Egypt	1.88	%		Tunisia	1.09	%
70.	Malaysia	1.86	%	121.	Iran	1.08	%
71.	Rwanda	1.84	%	122.	Korea, North	1.07	%
72.	Turkmenistan	1.82	%	123.	Andorra	1.06	%
73.	El Salvador	1.81	%	124.	Argentina	1.05	%
74.	Cambodia	1.80	%		Chile	1.05	%
75.	Macau	1.72	%	126.	Albania	1.03	%
	Tanzania	1.72	%		Ireland	1.03	%
77.	Haiti	1.67	%	128.	Virgin Islands	1.02	%
	Liberia	1.67	%	129.	Thailand	0.95	%
79.	Algeria	1.65	%	130.	Canada	0.94	%
80.	Morocco	1.64	%	131.	Australia	0.93	%
81.	Bolivia	1.63	%	132.	United States	0.92	%
	Uzbekistan	1.63	%	133.	Liechtenstein	0.90	%
83.	Central African Republic	1.62	%		Netherlands Antilles	0.90	%
	French Polynesia	1.62	%	135.	Mauritius	0.84	%
85.	Bahrain	1.61	%	136.	Sri Lanka	0.83	%
	Peru	1.61	%		Swaziland	0.83	%
	Vanuatu	1.61	%		Zimbabwe	0.83	%
88.	United Arab Emirates	1.57	%	139.	Mozambique	0.82	%
89.	Colombia	1.56	%	140.	Cape Verde	0.79	%
	Costa Rica	1.56	%		Uruguay	0.79	%
91.	Palau	1.54	%	142.	Bahamas, The	0.77	%
92.	Congo, Republic of the	1.53	%	143.	Malta	0.73	%
93.	Indonesia	1.52	%	144.	Bermuda	0.72	%
	Zambia	1.52	%	145.	Saint Helena	0.67	%
95.	Namibia	1.49	%	146.	Korea, South	0.66	%
96.	Venezuela	1.48	%	147.	Taiwan	0.65	%
97.	India	1.47	%	148.	Antigua and Barbuda	0.64	%
	Reunion	1.47	%	149.	Jamaica	0.61	%
99.	Kyrgyzstan	1.46	%	150.	China	0.60	%
100.	Ghana	1.45	%	151.	Puerto Rico	0.58	%
101.	Mexico	1.43	%	152.	Cyprus	0.56	%
102.	Mongolia	1.42	%	153.	Aruba	0.55	%
	Tuvalu	1.42	%	154.	Burma	0.52	%
104.	Fiji	1.41	%	155.	Netherlands	0.50	%
105.	Israel	1.39	%	156.	Iceland	0.49	%
106.	New Caledonia	1.38	%	157.	Bosnia and Herzegovina	0.48	%
	San Marino	1.38	%	158.	Norway	0.46	%
108.	Dominican Republic	1.36	%		Seychelles	0.46	%
	Panama	1.36	%	160.	Azerbaijan	0.44	%
110.	Lebanon	1.34	%		Guyana	0.44	%
111.	Vietnam	1.29	%		Monaco	0.44	%
112.	Eritrea	1.28	%	163.	France	0.42	%
113.	Kenya	1.27	%	164.	Macedonia, FYROM	0.40	%



165.	Barbados	0.38	%	2.	Mali	47.79	births/1,000 population
166.	Suriname	0.37	%	3.	Chad	47.06	births/1,000 population
167.	Cuba	0.34	%	4.	Uganda	46.57	births/1,000 population
	Saint Vincent and the Grenadines			5.	Somalia	46.42	births/1,000 population
		0.34	%	6.	Angola	45.57	births/1,000 population
169.	Croatia	0.31	%	7.	Liberia	45.28	births/1,000 population
170.	United Kingdom	0.30	%	8.	Congo, Democratic Republic of the		
171.	Denmark	0.28	%			45.12	births/1,000 population
172.	Austria	0.22	%	9.	Burkina Faso	44.78	births/1,000 population
173.	Switzerland	0.21	%	10.	Malawi	44.70	births/1,000 population
174.	Greece	0.19	%	11.	Sierra Leone	43.89	births/1,000 population
	Lesotho	0.19	%	12.	Yemen	43.23	births/1,000 population
176.	Kazakhstan	0.17	%	13.	Benin	43.15	births/1,000 population
	Portugal	0.17	%	14.	Guinea	42.50	births/1,000 population
178.	Spain	0.16	%	15.	Madagascar	42.16	births/1,000 population
179.	Belgium	0.14	%		Mauritania	42.16	births/1,000 population
	Finland	0.14	%	17.	Sao Tome and Principe		
	Slovakia	0.14	%			41.87	births/1,000 population
	Slovenia	0.14	%	18.	Djibouti	40.78	births/1,000 population
183.	Moldova	0.13	%	19.	Gambia, The	40.77	births/1,000 population
	Saint Kitts and Nevis	0.13	%	20.	Afghanistan	40.63	births/1,000 population
185.	Italy	0.11	%	21.	Rwanda	40.10	births/1,000 population
	Japan	0.11	%	22.	Cote d'Ivoire	40.01	births/1,000 population
187.	Grenada	0.08	%	23.	Ethiopia	39.81	births/1,000 population
188.	Serbia and Montenegro	0.07	%	24.	Burundi	39.72	births/1,000 population
189.	Germany	0.04	%	25.	Zambia	39.53	births/1,000 population
190.	Greenland	0.01	%	26.	Tanzania	39.50	births/1,000 population
	Holy See (Vatican City)	0.01	%	27.	Eritrea	39.44	births/1,000 population
	Niue	0.01	%	28.	Nigeria	38.75	births/1,000 population
	South Africa	0.01	%	29.	Comoros	38.50	births/1,000 population
	Sweden	0.01	%	30.	Guinea-Bissau	38.41	births/1,000 population
	Tokelau	0.01	%	31.	Mozambique	38.20	births/1,000 population
196.	Poland	0.00	%	32.	Oman	37.47	births/1,000 population
197.	Armenia	-0.07	%	33.	Saudi Arabia	37.20	births/1,000 population
198.	Czech Republic	-0.08	%	34.	Equatorial Guinea		
199.	Belarus	-0.12	%			36.94	births/1,000 population
200.	Romania	-0.21	%	35.	Laos	36.93	births/1,000 population
201.	Lithuania	-0.23	%	36.	Maldives	36.71	births/1,000 population
202.	Samoa	-0.27	%	37.	Gabon	36.54	births/1,000 population
203.	Hungary	-0.29	%	38.	Sudan	36.48	births/1,000 population
204.	Russia	-0.30	%	39.	Senegal	36.23	births/1,000 population
205.	Estonia	-0.49	%	40.	Central African Republic		
206.	Georgia	-0.52	%			35.93	births/1,000 population
207.	Botswana	-0.55	%	41.	Cameroon	35.49	births/1,000 population
208.	Dominica	-0.63	%	42.	Togo	35.23	births/1,000 population
				43.	Guatemala	35.05	births/1,000 population
				44.	Bhutan	34.82	births/1,000 population
				45.	Marshall Islands		
						34.18	births/1,000 population
				46.	Namibia	34.10	births/1,000 population
				47.	Haiti	34.06	births/1,000 population

**Rankings: Birth rate**  
(All Descending)

Rank	Country	Value / Unit
1.	Niger	49.54 births/1,000 population

48.	Iraq	33.66	births/1,000 population	94.	Kuwait	21.83	births/1,000 population
49.	Tajikistan	32.78	births/1,000 population	95.	Colombia	21.59	births/1,000 population
50.	Nepal	32.46	births/1,000 population	96.	Tuvalu	21.58	births/1,000 population
51.	Solomon Islands			97.	Indonesia	21.49	births/1,000 population
		32.45	births/1,000 population	98.	Mongolia	21.39	births/1,000 population
52.	Honduras	31.67	births/1,000 population	99.	French Guiana	21.33	births/1,000 population
53.	Kiribati	31.24	births/1,000 population	100.	Saint Lucia	20.93	births/1,000 population
54.	Papua New Guinea			101.	Panama	20.78	births/1,000 population
		31.07	births/1,000 population	102.	Reunion	20.17	births/1,000 population
55.	Belize	30.46	births/1,000 population	103.	Venezuela	19.78	births/1,000 population
56.	Zimbabwe	30.34	births/1,000 population	104.	Brunei	19.68	births/1,000 population
57.	Paraguay	30.14	births/1,000 population		Lebanon	19.68	births/1,000 population
58.	Bangladesh	29.90	births/1,000 population	106.	Vietnam	19.58	births/1,000 population
59.	Pakistan	29.59	births/1,000 population	107.	New Caledonia		
60.	Syria	29.54	births/1,000 population			19.45	births/1,000 population
61.	Congo, Republic of the			108.	Costa Rica	19.40	births/1,000 population
		29.46	births/1,000 population		Suriname	19.40	births/1,000 population
62.	Swaziland	29.37	births/1,000 population	110.	Azerbaijan	19.28	births/1,000 population
63.	Kenya	28.81	births/1,000 population	111.	Burma	19.15	births/1,000 population
64.	Turkmenistan	28.02	births/1,000 population	112.	Bahrain	19.02	births/1,000 population
65.	El Salvador	27.90	births/1,000 population		Palau	19.02	births/1,000 population
66.	East Timor	27.75	births/1,000 population	114.	South Africa	18.87	births/1,000 population
67.	Libya	27.43	births/1,000 population	115.	Israel	18.67	births/1,000 population
68.	Cambodia	27.28	births/1,000 population	116.	Bahamas, The	18.57	births/1,000 population
69.	Lesotho	27.26	births/1,000 population	117.	United Arab Emirates		
70.	Cape Verde	26.95	births/1,000 population			18.48	births/1,000 population
71.	Philippines	26.30	births/1,000 population	118.	Saint Kitts and Nevis		
72.	Nicaragua	26.29	births/1,000 population			18.45	births/1,000 population
73.	Nauru	26.09	births/1,000 population	119.	Kazakhstan	18.36	births/1,000 population
	Uzbekistan	26.09	births/1,000 population	120.	Antigua and Barbuda		
75.	Kyrgyzstan	26.06	births/1,000 population			18.23	births/1,000 population
76.	Ghana	25.84	births/1,000 population	121.	Albania	18.20	births/1,000 population
77.	Bolivia	25.53	births/1,000 population	122.	Guyana	17.87	births/1,000 population
78.	Botswana	25.50	births/1,000 population	123.	French Polynesia		
79.	Ecuador	24.94	births/1,000 population			17.74	births/1,000 population
80.	Tonga	24.51	births/1,000 population	124.	Brazil	17.67	births/1,000 population
81.	Egypt	24.36	births/1,000 population	125.	Korea, North	17.61	births/1,000 population
82.	Vanuatu	24.26	births/1,000 population	126.	Turkey	17.59	births/1,000 population
83.	Dominican Republic			127.	Argentina	17.47	births/1,000 population
		23.94	births/1,000 population	128.	Jamaica	17.35	births/1,000 population
84.	Malaysia	23.70	births/1,000 population	129.	Iran	17.23	births/1,000 population
85.	Jordan	23.68	births/1,000 population	130.	Uruguay	17.19	births/1,000 population
86.	India	23.28	births/1,000 population	131.	Saint Vincent and the Grenadines		
87.	American Samoa					17.16	births/1,000 population
		23.26	births/1,000 population	132.	Seychelles	16.89	births/1,000 population
	Morocco	23.26	births/1,000 population	133.	Dominica	16.78	births/1,000 population
89.	Fiji	23.06	births/1,000 population	134.	Tunisia	16.53	births/1,000 population
90.	Grenada	22.87	births/1,000 population	135.	Thailand	16.37	births/1,000 population
91.	Peru	22.81	births/1,000 population	136.	Sri Lanka	16.12	births/1,000 population
92.	Algeria	21.94	births/1,000 population	137.	Chile	16.10	births/1,000 population
93.	Mexico	21.92	births/1,000 population		Mauritius	16.10	births/1,000 population

139.	Greenland	16.09	births/1,000 population	182.	Romania	10.79	births/1,000 population
140.	Virgin Islands	15.80	births/1,000 population	183.	Hong Kong	10.71	births/1,000 population
141.	Netherlands Antilles			184.	Finland	10.54	births/1,000 population
		15.76	births/1,000 population	185.	San Marino	10.49	births/1,000 population
142.	Qatar	15.68	births/1,000 population	186.	Lithuania	10.48	births/1,000 population
143.	Samoa	15.41	births/1,000 population	187.	Poland	10.47	births/1,000 population
144.	British Virgin Islands			188.	Belgium	10.45	births/1,000 population
		15.00	births/1,000 population	189.	Belarus	10.18	births/1,000 population
	Puerto Rico	15.00	births/1,000 population	190.	Slovakia	10.10	births/1,000 population
146.	Anguilla	14.68	births/1,000 population	191.	Russia	10.09	births/1,000 population
147.	Ireland	14.63	births/1,000 population	192.	Spain	10.08	births/1,000 population
148.	Moldova	14.31	births/1,000 population	193.	Ukraine	9.89	births/1,000 population
149.	New Zealand	14.14	births/1,000 population	194.	Greece	9.79	births/1,000 population
	United States	14.14	births/1,000 population	195.	Sweden	9.71	births/1,000 population
151.	Iceland	14.13	births/1,000 population	196.	Andorra	9.65	births/1,000 population
152.	Cayman Islands			197.	Japan	9.61	births/1,000 population
		13.33	births/1,000 population	198.	Switzerland	9.59	births/1,000 population
153.	Macedonia, FYROM			199.	Monaco	9.46	births/1,000 population
		13.20	births/1,000 population	200.	Austria	9.43	births/1,000 population
154.	Barbados	13.15	births/1,000 population	201.	Hungary	9.32	births/1,000 population
155.	China	12.96	births/1,000 population	202.	Estonia	9.24	births/1,000 population
156.	Saint Helena	12.90	births/1,000 population	203.	Slovenia	9.23	births/1,000 population
157.	Cyprus	12.77	births/1,000 population	204.	Italy	9.18	births/1,000 population
158.	Croatia	12.76	births/1,000 population	205.	Czech Republic		
159.	Malta	12.75	births/1,000 population			9.01	births/1,000 population
	Singapore	12.75	births/1,000 population	206.	Germany	8.60	births/1,000 population
161.	Serbia and Montenegro			207.	Latvia	8.55	births/1,000 population
		12.74	births/1,000 population	208.	Bulgaria		
	Taiwan	12.74	births/1,000 population			8.02	births/1,000 population
	Trinidad and Tobago						
		12.74	births/1,000 population				
164.	Bosnia and Herzegovina						
		12.65	births/1,000 population				
165.	Korea, South	12.60	births/1,000 population				
166.	Armenia	12.57	births/1,000 population				
167.	Australia	12.55	births/1,000 population				
168.	France	12.54	births/1,000 population				
169.	Norway	12.17	births/1,000 population				
170.	Bermuda	12.13	births/1,000 population				
171.	Macau	12.07	births/1,000 population				
172.	Luxembourg	11.92	births/1,000 population				
173.	Cuba	11.87	births/1,000 population				
174.	Aruba	11.86	births/1,000 population				
175.	Georgia	11.79	births/1,000 population				
176.	Denmark	11.52	births/1,000 population				
177.	Portugal	11.45	births/1,000 population				
178.	Netherlands	11.31	births/1,000 population				
179.	Canada	10.99	births/1,000 population				
	United Kingdom						
		10.99	births/1,000 population				
181.	Liechtenstein	10.92	births/1,000 population				

#### Rankings: Death rate (All Descending)

Rank	Country	Value / Unit
1.	Botswana	31.00 deaths/1,000 population
2.	Mozambique	30.04 deaths/1,000 population
3.	Angola	25.83 deaths/1,000 population
4.	Lesotho	24.58 deaths/1,000 population
5.	Zambia	24.30 deaths/1,000 population
6.	Malawi	22.64 deaths/1,000 population
7.	Zimbabwe	22.02 deaths/1,000 population
8.	Rwanda	21.72 deaths/1,000 population
9.	Niger	21.71 deaths/1,000 population
10.	Swaziland	21.08 deaths/1,000 population
11.	Sierra Leone	20.66 deaths/1,000 population
12.	Ethiopia	20.17 deaths/1,000 population
13.	Central African Republic	
		19.73 deaths/1,000 population
14.	Djibouti	19.45 deaths/1,000 population
15.	Mali	19.21 deaths/1,000 population
16.	Namibia	19.17 deaths/1,000 population

17.	Burkina Faso	18.76	deaths/1,000 population	64.	Sweden	10.58	deaths/1,000 population
18.	South Africa	18.42	deaths/1,000 population	65.	Ghana	10.53	deaths/1,000 population
19.	Cote d'Ivoire	18.41	deaths/1,000 population	66.	Germany	10.34	deaths/1,000 population
20.	Liberia	17.84	deaths/1,000 population	67.	Portugal	10.21	deaths/1,000 population
21.	Burundi	17.80	deaths/1,000 population		United Kingdom	10.21	deaths/1,000 population
22.	Somalia	17.64	deaths/1,000 population	69.	Armenia	10.16	deaths/1,000 population
23.	Tanzania	17.38	deaths/1,000 population	70.	Slovenia	10.15	deaths/1,000 population
24.	Afghanistan	17.15	deaths/1,000 population	71.	Italy	10.12	deaths/1,000 population
25.	Uganda	16.95	deaths/1,000 population	72.	Belgium	10.07	deaths/1,000 population
26.	Guinea-Bissau	16.62	deaths/1,000 population	73.	Poland	9.96	deaths/1,000 population
27.	Ukraine	16.39	deaths/1,000 population	74.	Greece	9.86	deaths/1,000 population
28.	Chad	16.38	deaths/1,000 population	75.	Nepal	9.84	deaths/1,000 population
29.	Kenya	16.01	deaths/1,000 population	76.	Finland	9.82	deaths/1,000 population
30.	Guinea	15.70	deaths/1,000 population	77.	Norway	9.72	deaths/1,000 population
31.	Cameroon	15.30	deaths/1,000 population	78.	Austria	9.69	deaths/1,000 population
32.	Congo, Democratic Republic of the	14.87	deaths/1,000 population	79.	Azerbaijan	9.68	deaths/1,000 population
33.	Georgia	14.71	deaths/1,000 population	80.	Sudan	9.59	deaths/1,000 population
34.	Latvia	14.70	deaths/1,000 population	81.	Spain	9.48	deaths/1,000 population
35.	Bulgaria	14.34	deaths/1,000 population	82.	Guyana	9.27	deaths/1,000 population
36.	Congo, Republic of the	14.20	deaths/1,000 population	83.	Cambodia	9.26	deaths/1,000 population
37.	Belarus	14.05	deaths/1,000 population	84.	Slovakia	9.22	deaths/1,000 population
38.	Russia	13.99	deaths/1,000 population	85.	Kyrgyzstan	9.10	deaths/1,000 population
39.	Nigeria	13.76	deaths/1,000 population	86.	France	9.05	deaths/1,000 population
40.	Benin	13.65	deaths/1,000 population	87.	Yemen	9.04	deaths/1,000 population
41.	Bhutan	13.47	deaths/1,000 population	88.	Barbados	9.02	deaths/1,000 population
42.	Estonia	13.42	deaths/1,000 population	89.	Uruguay	8.97	deaths/1,000 population
43.	Haiti	13.36	deaths/1,000 population	90.	Turkmenistan	8.87	deaths/1,000 population
44.	Eritrea	13.23	deaths/1,000 population	91.	Comoros	8.86	deaths/1,000 population
45.	Mauritania	13.04	deaths/1,000 population	92.	Saint Kitts and Nevis	8.85	deaths/1,000 population
46.	Hungary	13.00	deaths/1,000 population	93.	Switzerland	8.82	deaths/1,000 population
47.	Lithuania	12.89	deaths/1,000 population	94.	Pakistan	8.79	deaths/1,000 population
48.	Monaco	12.82	deaths/1,000 population	95.	Luxembourg	8.78	deaths/1,000 population
49.	Moldova	12.70	deaths/1,000 population	96.	Trinidad and Tobago	8.71	deaths/1,000 population
50.	Equatorial Guinea	12.54	deaths/1,000 population	97.	Bahamas, The	8.68	deaths/1,000 population
51.	Laos	12.39	deaths/1,000 population	98.	Netherlands	8.66	deaths/1,000 population
52.	Gambia, The	12.35	deaths/1,000 population	99.	Bangladesh	8.63	deaths/1,000 population
53.	Romania	12.25	deaths/1,000 population		Kiribati	8.63	deaths/1,000 population
54.	Burma	12.17	deaths/1,000 population	101.	Japan	8.55	deaths/1,000 population
55.	Madagascar	11.88	deaths/1,000 population	102.	India	8.49	deaths/1,000 population
56.	Togo	11.51	deaths/1,000 population	103.	Tajikistan	8.46	deaths/1,000 population
57.	Croatia	11.25	deaths/1,000 population	104.	United States	8.44	deaths/1,000 population
58.	Gabon	11.17	deaths/1,000 population	105.	Bosnia and Herzegovina	8.21	deaths/1,000 population
59.	Senegal	10.88	deaths/1,000 population	106.	Vanuatu	8.13	deaths/1,000 population
60.	Kazakhstan	10.78	deaths/1,000 population	107.	Uzbekistan	7.97	deaths/1,000 population
61.	Czech Republic	10.74	deaths/1,000 population	108.	Ireland	7.94	deaths/1,000 population
62.	Denmark	10.72	deaths/1,000 population	109.	Bolivia	7.91	deaths/1,000 population
63.	Serbia and Montenegro	10.62	deaths/1,000 population	110.	San Marino	7.86	deaths/1,000 population



111.	Malta	7.80	deaths/1,000 population	157.	Brazil	6.13	deaths/1,000 population
112.	Macedonia, FYROM	7.78	deaths/1,000 population	158.	Saint Vincent and the Grenadines	6.08	deaths/1,000 population
113.	Puerto Rico	7.68	deaths/1,000 population	159.	Belize	6.05	deaths/1,000 population
114.	Greenland	7.66	deaths/1,000 population	160.	Korea, South	6.03	deaths/1,000 population
115.	Maldives	7.65	deaths/1,000 population	161.	El Salvador	6.01	deaths/1,000 population
116.	Cyprus	7.63	deaths/1,000 population	162.	Turkey	5.95	deaths/1,000 population
	Papua New Guinea	7.63	deaths/1,000 population	163.	Iraq	5.84	deaths/1,000 population
118.	Canada	7.61	deaths/1,000 population	164.	Saudi Arabia	5.79	deaths/1,000 population
119.	Argentina	7.58	deaths/1,000 population	165.	Morocco	5.78	deaths/1,000 population
120.	New Zealand	7.54	deaths/1,000 population	166.	Andorra	5.74	deaths/1,000 population
121.	Bermuda	7.46	deaths/1,000 population	167.	Fiji	5.70	deaths/1,000 population
	Grenada	7.46	deaths/1,000 population	168.	Peru	5.69	deaths/1,000 population
123.	Cuba	7.38	deaths/1,000 population	169.	Virgin Islands	5.68	deaths/1,000 population
124.	Tuvalu	7.34	deaths/1,000 population	170.	Antigua and Barbuda	5.64	deaths/1,000 population
125.	Australia	7.31	deaths/1,000 population	171.	Chile	5.63	deaths/1,000 population
126.	Mongolia	7.18	deaths/1,000 population		Colombia	5.63	deaths/1,000 population
127.	Sao Tome and Principe	7.11	deaths/1,000 population		New Caledonia	5.63	deaths/1,000 population
128.	Nauru	7.08	deaths/1,000 population	174.	Philippines	5.60	deaths/1,000 population
129.	Palau	7.00	deaths/1,000 population	175.	Iran	5.54	deaths/1,000 population
130.	Dominica	6.99	deaths/1,000 population		Tonga	5.54	deaths/1,000 population
131.	Iceland	6.95	deaths/1,000 population	177.	Reunion	5.49	deaths/1,000 population
132.	Korea, North	6.93	deaths/1,000 population	178.	Anguilla	5.42	deaths/1,000 population
133.	Dominican Republic	6.88	deaths/1,000 population		Jamaica	5.42	deaths/1,000 population
134.	Cape Verde	6.86	deaths/1,000 population	180.	Egypt	5.35	deaths/1,000 population
	Thailand	6.86	deaths/1,000 population	181.	Ecuador	5.29	deaths/1,000 population
136.	Liechtenstein	6.85	deaths/1,000 population	182.	Saint Lucia	5.24	deaths/1,000 population
137.	Suriname	6.83	deaths/1,000 population	183.	Malaysia	5.12	deaths/1,000 population
138.	Mauritius	6.81	deaths/1,000 population	184.	Algeria	5.09	deaths/1,000 population
139.	Guatemala	6.78	deaths/1,000 population	185.	Syria	5.04	deaths/1,000 population
140.	China	6.74	deaths/1,000 population	186.	Marshall Islands	5.03	deaths/1,000 population
141.	Seychelles	6.49	deaths/1,000 population	187.	Tunisia	5.02	deaths/1,000 population
142.	Albania	6.48	deaths/1,000 population	188.	Mexico	4.97	deaths/1,000 population
143.	Sri Lanka	6.46	deaths/1,000 population	189.	Venezuela	4.90	deaths/1,000 population
144.	Honduras	6.44	deaths/1,000 population	190.	French Guiana	4.80	deaths/1,000 population
145.	East Timor	6.41	deaths/1,000 population	191.	Cayman Islands	4.70	deaths/1,000 population
	Samoa	6.41	deaths/1,000 population		Nicaragua	4.69	deaths/1,000 population
147.	Netherlands Antilles	6.40	deaths/1,000 population	193.	Paraguay	4.64	deaths/1,000 population
148.	Aruba	6.38	deaths/1,000 population	194.	French Polynesia	4.53	deaths/1,000 population
149.	Lebanon	6.32	deaths/1,000 population	195.	British Virgin Islands	4.46	deaths/1,000 population
150.	Indonesia	6.26	deaths/1,000 population			4.43	deaths/1,000 population
151.	Panama	6.25	deaths/1,000 population	196.	Qatar	4.38	deaths/1,000 population
152.	Saint Helena	6.24	deaths/1,000 population	197.	American Samoa	4.31	deaths/1,000 population
153.	Israel	6.20	deaths/1,000 population			4.31	deaths/1,000 population
	Taiwan	6.20	deaths/1,000 population	198.	Costa Rica	4.31	deaths/1,000 population
155.	Hong Kong	6.19	deaths/1,000 population		Singapore	4.31	deaths/1,000 population
	Vietnam	6.19	deaths/1,000 population				

200.	Solomon Islands	4.12	deaths/1,000 population	18.	Somalia	5.56	migrant(s)/1,000 population
201.	United Arab Emirates	4.02	deaths/1,000 population	19.	Liechtenstein	4.89	migrant(s)/1,000 population
202.	Bahrain	3.99	deaths/1,000 population	20.	New Zealand	4.26	migrant(s)/1,000 population
203.	Oman	3.97	deaths/1,000 population	21.	Australia	4.05	migrant(s)/1,000 population
204.	Macau	3.85	deaths/1,000 population	22.	Brunei	3.75	migrant(s)/1,000 population
205.	Libya	3.49	deaths/1,000 population	23.	Ireland	3.57	migrant(s)/1,000 population
206.	Brunei	3.39	deaths/1,000 population	24.	United States	3.52	migrant(s)/1,000 population
207.	Jordan	2.62	deaths/1,000 population	25.	Palau	3.40	migrant(s)/1,000 population
208.	Kuwait	2.45	deaths/1,000 population	26.	American Samoa	3.29	migrant(s)/1,000 population
<b>Net Migration</b>				27.	French Polynesia	2.99	migrant(s)/1,000 population
<b>(All Decsending)</b>				28.	Belarus	2.66	migrant(s)/1,000 population
Rank	Country	Value / Unit		29.	Bermuda	2.56	migrant(s)/1,000 population
1.	Singapore	25.76	migrant(s)/1,000 population	30.	Austria	2.44	migrant(s)/1,000 population
2.	Cayman Islands	19.27	migrant(s)/1,000 population	31.	Netherlands	2.35	migrant(s)/1,000 population
3.	Qatar	17.48	migrant(s)/1,000 population	32.	Malta	2.34	migrant(s)/1,000 population
4.	Kuwait	14.04	migrant(s)/1,000 population		Slovenia	2.34	migrant(s)/1,000 population
5.	Anguilla	12.80	migrant(s)/1,000 population	34.	United Kingdom	2.20	migrant(s)/1,000 population
6.	San Marino	11.13	migrant(s)/1,000 population	35.	Germany	2.18	migrant(s)/1,000 population
7.	British Virgin Islands	10.45	migrant(s)/1,000 population	36.	Norway	2.09	migrant(s)/1,000 population
8.	Afghanistan	10.32	migrant(s)/1,000 population	37.	Italy	2.07	migrant(s)/1,000 population
9.	Luxembourg	9.14	migrant(s)/1,000 population	38.	Denmark	2.04	migrant(s)/1,000 population
10.	Macau	8.93	migrant(s)/1,000 population	39.	Greece	1.96	migrant(s)/1,000 population
11.	Monaco	7.78	migrant(s)/1,000 population	40.	Gambia, The	1.89	migrant(s)/1,000 population
12.	Hong Kong	7.64	migrant(s)/1,000 population	41.	Croatia	1.61	migrant(s)/1,000 population
13.	French Guiana	7.49	migrant(s)/1,000 population	42.	Israel	1.39	migrant(s)/1,000 population
14.	Jordan	6.78	migrant(s)/1,000 population	43.	Switzerland	1.37	migrant(s)/1,000 population
15.	Andorra	6.67	migrant(s)/1,000 population				
16.	Sierra Leone	6.19	migrant(s)/1,000 population				
17.	Canada	6.01	migrant(s)/1,000 population				

44.	Saudi Arabia	1.23 migrant(s)/1,000 population	Bhutan	0.00 migrant(s)/1,000 population
45.	United Arab Emirates	1.22 migrant(s)/1,000 population	Botswana	0.00 migrant(s)/1,000 population
46.	Bahrain	1.07 migrant(s)/1,000 population	Burkina Faso	0.00 migrant(s)/1,000 population
47.	Sweden	1.00 migrant(s)/1,000 population	Cambodia	0.00 migrant(s)/1,000 population
48.	Spain	0.99 migrant(s)/1,000 population	Central African Republic	0.00 migrant(s)/1,000 population
49.	Belgium	0.97 migrant(s)/1,000 population	Chad	0.00 migrant(s)/1,000 population
	Czech Republic	0.97 migrant(s)/1,000 population	Chile	0.00 migrant(s)/1,000 population
51.	Russia	0.91 migrant(s)/1,000 population	Congo, Republic of the	0.00 migrant(s)/1,000 population
52.	Hungary	0.78 migrant(s)/1,000 population	Djibouti	0.00 migrant(s)/1,000 population
53.	France	0.66 migrant(s)/1,000 population	East Timor	0.00 migrant(s)/1,000 population
54.	Finland	0.63 migrant(s)/1,000 population	Ethiopia	0.00 migrant(s)/1,000 population
55.	Argentina	0.62 migrant(s)/1,000 population	Gabon	0.00 migrant(s)/1,000 population
56.	Slovakia	0.53 migrant(s)/1,000 population	Indonesia	0.00 migrant(s)/1,000 population
57.	Costa Rica	0.51 migrant(s)/1,000 population	Iraq	0.00 migrant(s)/1,000 population
58.	Portugal	0.49 migrant(s)/1,000 population	Japan	0.00 migrant(s)/1,000 population
59.	Cyprus	0.43 migrant(s)/1,000 population	Kiribati	0.00 migrant(s)/1,000 population
60.	Bosnia and Herzegovina	0.32 migrant(s)/1,000 population	Korea, North	0.00 migrant(s)/1,000 population
61.	Oman	0.29 migrant(s)/1,000 population	Korea, South	0.00 migrant(s)/1,000 population
62.	Nigeria	0.26 migrant(s)/1,000 population	Laos	0.00 migrant(s)/1,000 population
63.	Sudan	0.24 migrant(s)/1,000 population	Lebanon	0.00 migrant(s)/1,000 population
64.	Senegal	0.21 migrant(s)/1,000 population	Libya	0.00 migrant(s)/1,000 population
65.	Lithuania	0.14 migrant(s)/1,000 population	Madagascar	0.00 migrant(s)/1,000 population
66.	Virgin Islands	0.12 migrant(s)/1,000 population	Malawi	0.00 migrant(s)/1,000 population
67.	Angola	0.00 migrant(s)/1,000 population	Malaysia	0.00 migrant(s)/1,000 population
	Belize	0.00 migrant(s)/1,000 population	Maldives	0.00 migrant(s)/1,000 population
	Benin	0.00 migrant(s)/1,000 population	Mauritania	0.00 migrant(s)/1,000 population
				0.00 migrant(s)/1,000 population

	Mongolia		122.	Cote d'Ivoire
	0.00 migrant(s)/1,000 population			-0.08 migrant(s)/1,000 population
	Mozambique			Paraguay
	0.00 migrant(s)/1,000 population			-0.08 migrant(s)/1,000 population
	Namibia		124.	Burundi
	0.00 migrant(s)/1,000 population			-0.12 migrant(s)/1,000 population
	Nauru		125.	Kenya
	0.00 migrant(s)/1,000 population			-0.15 migrant(s)/1,000 population
	Nepal		126.	China
	0.00 migrant(s)/1,000 population			-0.23 migrant(s)/1,000 population
	New Caledonia			Egypt
	0.00 migrant(s)/1,000 population			-0.23 migrant(s)/1,000 population
	Papua New Guinea		128.	Moldova
	0.00 migrant(s)/1,000 population			-0.27 migrant(s)/1,000 population
	Reunion		129.	Barbados
	0.00 migrant(s)/1,000 population			-0.31 migrant(s)/1,000 population
	Rwanda		130.	Colombia
	0.00 migrant(s)/1,000 population			-0.32 migrant(s)/1,000 population
	Saint Helena		131.	Mali
	0.00 migrant(s)/1,000 population			-0.34 migrant(s)/1,000 population
	Solomon Islands		132.	South Africa
	0.00 migrant(s)/1,000 population			-0.35 migrant(s)/1,000 population
	Swaziland			Uruguay
	0.00 migrant(s)/1,000 population			-0.35 migrant(s)/1,000 population
	Syria		134.	Algeria
	0.00 migrant(s)/1,000 population			-0.40 migrant(s)/1,000 population
	Taiwan		135.	Netherlands Antilles
	0.00 migrant(s)/1,000 population			-0.41 migrant(s)/1,000 population
	Thailand			Ukraine
	0.00 migrant(s)/1,000 population			-0.41 migrant(s)/1,000 population
	Togo		137.	Vietnam
	0.00 migrant(s)/1,000 population			-0.46 migrant(s)/1,000 population
	Tonga		138.	Poland
	0.00 migrant(s)/1,000 population			-0.49 migrant(s)/1,000 population
	Turkey		139.	Ecuador
	0.00 migrant(s)/1,000 population			-0.52 migrant(s)/1,000 population
	Tuvalu		140.	Romania
	0.00 migrant(s)/1,000 population			-0.60 migrant(s)/1,000 population
	Uganda			Tunisia
	0.00 migrant(s)/1,000 population			-0.60 migrant(s)/1,000 population
	Vanuatu		142.	Niger
	0.00 migrant(s)/1,000 population			-0.69 migrant(s)/1,000 population
	Yemen		143.	Estonia
	0.00 migrant(s)/1,000 population			-0.71 migrant(s)/1,000 population
	Zambia		144.	Bangladesh
	0.00 migrant(s)/1,000 population			-0.72 migrant(s)/1,000 population
119.	Brazil		145.	Lesotho
	-0.03 migrant(s)/1,000 population			-0.74 migrant(s)/1,000 population
120.	India		146.	Pakistan
	-0.07 migrant(s)/1,000 population			-0.75 migrant(s)/1,000 population
	Venezuela		147.	Ghana
	-0.07 migrant(s)/1,000 population			-0.83 migrant(s)/1,000 population



148.	Iran	174.	Mexico
	-0.86 migrant(s)/1,000 population		-2.65 migrant(s)/1,000 population
149.	Mauritius	175.	Sao Tome and Principe
	-0.91 migrant(s)/1,000 population		-2.93 migrant(s)/1,000 population
150.	Turkmenistan	176.	Tajikistan
	-0.92 migrant(s)/1,000 population		-3.06 migrant(s)/1,000 population
151.	Panama	177.	Guinea
	-0.97 migrant(s)/1,000 population		-3.14 migrant(s)/1,000 population
152.	Morocco	178.	Armenia
	-1.03 migrant(s)/1,000 population		-3.15 migrant(s)/1,000 population
	Peru		Saint Lucia
	-1.03 migrant(s)/1,000 population		-3.15 migrant(s)/1,000 population
154.	Cuba	180.	Fiji
	-1.05 migrant(s)/1,000 population		-3.24 migrant(s)/1,000 population
155.	Latvia	181.	Dominican Republic
	-1.19 migrant(s)/1,000 population		-3.43 migrant(s)/1,000 population
156.	Congo, Democratic Republic of the	182.	El Salvador
	-1.26 migrant(s)/1,000 population		-3.81 migrant(s)/1,000 population
157.	Nicaragua	183.	Haiti
	-1.27 migrant(s)/1,000 population		-4.03 migrant(s)/1,000 population
158.	Sri Lanka	184.	Guyana
	-1.35 migrant(s)/1,000 population		-4.16 migrant(s)/1,000 population
159.	Bolivia	185.	Bulgaria
	-1.37 migrant(s)/1,000 population		-4.58 migrant(s)/1,000 population
160.	Serbia and Montenegro	186.	Tanzania
	-1.38 migrant(s)/1,000 population		-4.91 migrant(s)/1,000 population
161.	Albania	187.	Azerbaijan
	-1.39 migrant(s)/1,000 population		-5.16 migrant(s)/1,000 population
162.	Macedonia, FYROM	188.	Jamaica
	-1.46 migrant(s)/1,000 population		-5.78 migrant(s)/1,000 population
163.	Philippines	189.	Seychelles
	-1.50 migrant(s)/1,000 population		-5.84 migrant(s)/1,000 population
164.	Puerto Rico	190.	Kazakhstan
	-1.54 migrant(s)/1,000 population		-5.89 migrant(s)/1,000 population
165.	Guinea-Bissau	191.	Marshall Islands
	-1.60 migrant(s)/1,000 population		-6.18 migrant(s)/1,000 population
166.	Guatemala	192.	Antigua and Barbuda
	-1.71 migrant(s)/1,000 population		-6.19 migrant(s)/1,000 population
167.	Burma	193.	Saint Vincent and the Grenadines
	-1.81 migrant(s)/1,000 population		-7.66 migrant(s)/1,000 population
168.	Uzbekistan	194.	Saint Kitts and Nevis
	-1.83 migrant(s)/1,000 population		-8.31 migrant(s)/1,000 population
169.	Honduras	195.	Greenland
	-2.04 migrant(s)/1,000 population		-8.37 migrant(s)/1,000 population
170.	Bahamas, The	196.	Suriname
	-2.21 migrant(s)/1,000 population		-8.84 migrant(s)/1,000 population
171.	Iceland	197.	Liberia
	-2.26 migrant(s)/1,000 population		-10.70 migrant(s)/1,000 population
172.	Georgia	198.	Trinidad and Tobago
	-2.30 migrant(s)/1,000 population		-10.79 migrant(s)/1,000 population
173.	Kyrgyzstan	199.	Samoa
	-2.37 migrant(s)/1,000 population		-11.67 migrant(s)/1,000 population

200.	Cape Verde		Guatemala	1.03 male(s)/female
	-12.16 migrant(s)/1,000 population		Saint Helena	1.03 male(s)/female
201.	Eritrea		Saint Vincent and the Grenadines	1.03 male(s)/female
	-13.38 migrant(s)/1,000 population			
202.	Grenada		Solomon Islands	1.03 male(s)/female
	-14.56 migrant(s)/1,000 population		Sudan	1.03 male(s)/female
203.	Dominica		Suriname	1.03 male(s)/female
	-16.11 migrant(s)/1,000 population	45.	Algeria	1.02 male(s)/female

**Rankings: Sex ratio, total population**  
(All Descending)

Rank	Country	Value / Unit		
1.	Qatar	1.90 male(s)/female		
2.	Kuwait	1.52 male(s)/female		
3.	United Arab Emirates	1.47 male(s)/female		
4.	Samoa	1.39 male(s)/female		
5.	Bahrain	1.28 male(s)/female		
	Oman	1.28 male(s)/female	56.	American Samoa
7.	Saudi Arabia	1.22 male(s)/female		Cameroon
8.	Palau	1.14 male(s)/female		Cote d'Ivoire
9.	Greenland	1.13 male(s)/female		Dominica
10.	French Guiana	1.12 male(s)/female		Fiji
11.	Brunei	1.10 male(s)/female		Guyana
	Jordan	1.10 male(s)/female		Kenya
13.	Andorra	1.09 male(s)/female		Korea, South
14.	Grenada	1.08 male(s)/female		Malaysia
15.	Bhutan	1.07 male(s)/female		Nauru
	French Polynesia	1.07 male(s)/female		New Caledonia
	India	1.07 male(s)/female		Paraguay
18.	Afghanistan	1.06 male(s)/female		Peru
	British Virgin Islands	1.06 male(s)/female	70.	Cuba
	China	1.06 male(s)/female		Cyprus
	Djibouti	1.06 male(s)/female		Ethiopia
	Libya	1.06 male(s)/female		Gambia, The
23.	Bangladesh	1.05 male(s)/female		Ghana
	Maldives	1.05 male(s)/female		Guinea
	Nepal	1.05 male(s)/female		Honduras
	Pakistan	1.05 male(s)/female		Iceland
	Papua New Guinea	1.05 male(s)/female		Indonesia
	Syria	1.05 male(s)/female		Jamaica
	Trinidad and Tobago	1.05 male(s)/female		Macedonia, FYROM
	Vanuatu	1.05 male(s)/female		Mongolia
31.	East Timor	1.04 male(s)/female		Morocco
	Iran	1.04 male(s)/female		Namibia
	Marshall Islands	1.04 male(s)/female		Nicaragua
	Taiwan	1.04 male(s)/female		Niger
	Yemen	1.04 male(s)/female		Philippines
36.	Anguilla	1.03 male(s)/female		Somalia
	Belize	1.03 male(s)/female		Zambia
	Dominican Republic	1.03 male(s)/female	89.	Antigua and Barbuda

	Australia	0.99 male(s)/female		Greece	0.97 male(s)/female
	Burma	0.99 male(s)/female		Luxembourg	0.97 male(s)/female
	Ecuador	0.99 male(s)/female		Mexico	0.97 male(s)/female
	Eritrea	0.99 male(s)/female		Saint Lucia	0.97 male(s)/female
	Hong Kong	0.99 male(s)/female		Sao Tome and Principe	
	Israel	0.99 male(s)/female			0.97 male(s)/female
	Kiribati	0.99 male(s)/female		Sri Lanka	0.97 male(s)/female
	Madagascar	0.99 male(s)/female		Togo	0.97 male(s)/female
	Malawi	0.99 male(s)/female		United States	0.97 male(s)/female
	New Zealand	0.99 male(s)/female	147.	Albania	0.96 male(s)/female
	Rwanda	0.99 male(s)/female		Bahamas, The	0.96 male(s)/female
	Swaziland	0.99 male(s)/female		Belgium	0.96 male(s)/female
	Tajikistan	0.99 male(s)/female		Bermuda	0.96 male(s)/female
	Tonga	0.99 male(s)/female		Botswana	0.96 male(s)/female
	Uganda	0.99 male(s)/female		Cayman Islands	0.96 male(s)/female
105.	Bolivia	0.98 male(s)/female		Colombia	0.96 male(s)/female
	Brazil	0.98 male(s)/female		Germany	0.96 male(s)/female
	Burundi	0.98 male(s)/female		Italy	0.96 male(s)/female
	Canada	0.98 male(s)/female		Japan	0.96 male(s)/female
	Central African Republic			Kyrgyzstan	0.96 male(s)/female
		0.98 male(s)/female		Lesotho	0.96 male(s)/female
	Chile	0.98 male(s)/female		Mali	0.96 male(s)/female
	Comoros	0.98 male(s)/female		Mozambique	0.96 male(s)/female
	Congo, Democratic Republic of the			Senegal	0.96 male(s)/female
		0.98 male(s)/female		Slovenia	0.96 male(s)/female
	Congo, Republic of the		164.	Spain	0.96 male(s)/female
		0.98 male(s)/female		Armenia	0.95 male(s)/female
	Denmark	0.98 male(s)/female		Austria	0.95 male(s)/female
	Gabon	0.98 male(s)/female		Azerbaijan	0.95 male(s)/female
	Haiti	0.98 male(s)/female		Chad	0.95 male(s)/female
	Ireland	0.98 male(s)/female		Czech Republic	0.95 male(s)/female
	Laos	0.98 male(s)/female		El Salvador	0.95 male(s)/female
	Liberia	0.98 male(s)/female		Equatorial Guinea	0.95 male(s)/female
	Malta	0.98 male(s)/female		Finland	0.95 male(s)/female
	Mauritania	0.98 male(s)/female		France	0.95 male(s)/female
	Mauritius	0.98 male(s)/female		Liechtenstein	0.95 male(s)/female
	Netherlands	0.98 male(s)/female		Romania	0.95 male(s)/female
	Norway	0.98 male(s)/female		Serbia and Montenegro	
	Saint Kitts and Nevis	0.98 male(s)/female			0.95 male(s)/female
	South Africa	0.98 male(s)/female		Singapore	0.95 male(s)/female
	Sweden	0.98 male(s)/female		Slovakia	0.95 male(s)/female
	Switzerland	0.98 male(s)/female		Tuvalu	0.95 male(s)/female
	Tanzania	0.98 male(s)/female		Uruguay	0.95 male(s)/female
	Thailand	0.98 male(s)/female	180.	Cambodia	0.94 male(s)/female
	Turkmenistan	0.98 male(s)/female		Cape Verde	0.94 male(s)/female
	United Kingdom	0.98 male(s)/female		Croatia	0.94 male(s)/female
	Uzbekistan	0.98 male(s)/female		Guinea-Bissau	0.94 male(s)/female
	Vietnam	0.98 male(s)/female		Korea, North	0.94 male(s)/female
136.	Argentina	0.97 male(s)/female		Lebanon	0.94 male(s)/female
	Benin	0.97 male(s)/female		Poland	0.94 male(s)/female
	Burkina Faso	0.97 male(s)/female	187.	Aruba	0.93 male(s)/female

	Barbados	0.93 male(s)/female			Guinea	93.30 deaths/1,000 live births
	Bulgaria	0.93 male(s)/female	25.		Equatorial Guinea	89.02 deaths/1,000 live births
	Puerto Rico	0.93 male(s)/female			Laos	88.94 deaths/1,000 live births
	San Marino	0.93 male(s)/female	26.		Uganda	87.90 deaths/1,000 live births
	Seychelles	0.93 male(s)/female	27.		Benin	86.76 deaths/1,000 live births
	Sierra Leone	0.93 male(s)/female	28.		Lesotho	86.21 deaths/1,000 live births
194.	Kazakhstan	0.92 male(s)/female	29.		Azerbaijan	82.41 deaths/1,000 live births
	Netherlands Antilles	0.92 male(s)/female	30.		Madagascar	80.21 deaths/1,000 live births
	Portugal	0.92 male(s)/female	31.		Comoros	79.51 deaths/1,000 live births
197.	Georgia	0.91 male(s)/female	32.		Pakistan	76.53 deaths/1,000 live births
	Hungary	0.91 male(s)/female	33.		Eritrea	76.32 deaths/1,000 live births
	Macau	0.91 male(s)/female	34.		Haiti	76.01 deaths/1,000 live births
	Moldova	0.91 male(s)/female	35.		Cambodia	75.94 deaths/1,000 live births
	Monaco	0.91 male(s)/female	36.		Kyrgyzstan	75.34 deaths/1,000 live births
202.	Belarus	0.88 male(s)/female	37.		Gambia, The	74.93 deaths/1,000 live births
	Lithuania	0.88 male(s)/female	38.		Mauritania	73.80 deaths/1,000 live births
	Russia	0.88 male(s)/female	39.		Turkmenistan	73.17 deaths/1,000 live births
205.	Virgin Islands	0.87 male(s)/female	40.		Burundi	71.54 deaths/1,000 live births
206.	Estonia	0.86 male(s)/female	41.		Uzbekistan	71.51 deaths/1,000 live births
	Ukraine	0.86 male(s)/female	42.		Nigeria	71.35 deaths/1,000 live births
			43.		Nepal	70.57 deaths/1,000 live births
			44.		Burma	70.35 deaths/1,000 live births
			45.		Cameroon	70.12 deaths/1,000 live births
			46.		Togo	68.73 deaths/1,000 live births
			47.		Namibia	68.44 deaths/1,000 live births
			48.		Swaziland	67.44 deaths/1,000 live births
			49.		Botswana	67.34 deaths/1,000 live births
			50.		Zimbabwe	66.47 deaths/1,000 live births
			51.		Bangladesh	66.08 deaths/1,000 live births
			52.		Sudan	65.59 deaths/1,000 live births
			53.		Yemen	65.02 deaths/1,000 live births
			54.		Kenya	63.36 deaths/1,000 live births
			55.		South Africa	60.84 deaths/1,000 live births
			56.		Maldives	60.13 deaths/1,000 live births
			57.		India	59.59 deaths/1,000 live births
			58.		Kazakhstan	58.73 deaths/1,000 live births
			59.		Vanuatu	58.11 deaths/1,000 live births
			60.		Senegal	57.57 deaths/1,000 live births
			61.		Mongolia	57.16 deaths/1,000 live births
			62.		Bolivia	56.05 deaths/1,000 live births
			63.		Iraq	55.16 deaths/1,000 live births
			64.		Gabon	55.05 deaths/1,000 live births
			65.		Papua New Guinea	54.84 deaths/1,000 live births
			66.		Ghana	53.02 deaths/1,000 live births
			67.		Kiribati	51.26 deaths/1,000 live births
			68.		Georgia	51.24 deaths/1,000 live births
			69.		Cape Verde	50.50 deaths/1,000 live births
			70.		East Timor	50.47 deaths/1,000 live births
			71.		Saudi Arabia	47.94 deaths/1,000 live births
			72.			

### Rankings: Infant mortality rate

(All Descending)

Rank	Country	Value / Unit	
1.	Mozambique	199.00 deaths/1,000 live births	
2.	Angola	193.82 deaths/1,000 live births	
3.	Sierra Leone	146.86 deaths/1,000 live births	
4.	Afghanistan	142.48 deaths/1,000 live births	
5.	Liberia	132.18 deaths/1,000 live births	
6.	Niger	123.64 deaths/1,000 live births	
7.	Somalia	120.34 deaths/1,000 live births	
8.	Mali	119.20 deaths/1,000 live births	
9.	Tajikistan	113.43 deaths/1,000 live births	
10.	Guinea-Bissau	110.29 deaths/1,000 live births	
11.	Djibouti	106.96 deaths/1,000 live births	
12.	Malawi	105.15 deaths/1,000 live births	
13.	Bhutan	104.68 deaths/1,000 live births	
14.	Tanzania	103.68 deaths/1,000 live births	
15.	Ethiopia	103.22 deaths/1,000 live births	
16.	Rwanda	102.61 deaths/1,000 live births	
17.	Burkina Faso	99.78 deaths/1,000 live births	
18.	Zambia	99.29 deaths/1,000 live births	
19.	Cote d'Ivoire	98.33 deaths/1,000 live births	
20.	Congo, Democratic Republic of the	96.56 deaths/1,000 live births	
21.	Chad	95.74 deaths/1,000 live births	
22.	Congo, Republic of the	95.34 deaths/1,000 live births	
23.	Central African Republic	93.30 deaths/1,000 live births	



73.	Sao Tome and Principe	46.04 deaths/1,000 live births	118.	Ukraine	20.87 deaths/1,000 live births
74.	Morocco	44.87 deaths/1,000 live births	119.	Saint Helena	20.70 deaths/1,000 live births
75.	Turkey	44.20 deaths/1,000 live births	120.	Qatar	20.03 deaths/1,000 live births
76.	Iran	44.17 deaths/1,000 live births	121.	Russia	19.51 deaths/1,000 live births
77.	Moldova	41.58 deaths/1,000 live births	122.	Malaysia	19.00 deaths/1,000 live births
78.	Armenia	40.86 deaths/1,000 live births	123.	Jordan	18.86 deaths/1,000 live births
79.	Indonesia	38.09 deaths/1,000 live births	124.	British Virgin Islands	18.80 deaths/1,000 live births
80.	Guatemala	37.92 deaths/1,000 live births	125.	Bahrain	18.59 deaths/1,000 live births
81.	Algeria	37.74 deaths/1,000 live births	126.	Romania	18.40 deaths/1,000 live births
82.	Guyana	37.55 deaths/1,000 live births	127.	Serbia and Montenegro	16.90 deaths/1,000 live births
83.	Albania	37.28 deaths/1,000 live births	128.	Greenland	16.80 deaths/1,000 live births
84.	Peru	36.97 deaths/1,000 live births	129.	Seychelles	16.41 deaths/1,000 live births
85.	Egypt	35.26 deaths/1,000 live births	130.	Argentina	16.16 deaths/1,000 live births
86.	Dominican Republic	34.19 deaths/1,000 live births	131.	Mauritius	16.11 deaths/1,000 live births
87.	Ecuador	31.97 deaths/1,000 live births	132.	Palau	15.76 deaths/1,000 live births
88.	Brazil	31.74 deaths/1,000 live births	133.	Saint Vincent and the Grenadines	15.70 deaths/1,000 live births
89.	Syria	31.67 deaths/1,000 live births	134.	United Arab Emirates	15.58 deaths/1,000 live births
90.	Marshall Islands	31.58 deaths/1,000 live births	135.	Saint Kitts and Nevis	15.39 deaths/1,000 live births
91.	Nicaragua	31.39 deaths/1,000 live births	136.	Dominica	15.34 deaths/1,000 live births
92.	Vietnam	30.83 deaths/1,000 live births	137.	Sri Lanka	15.22 deaths/1,000 live births
93.	Honduras	29.96 deaths/1,000 live births	138.	Grenada	14.63 deaths/1,000 live births
94.	Samoa	29.73 deaths/1,000 live births	139.	Latvia	14.59 deaths/1,000 live births
95.	Paraguay	27.71 deaths/1,000 live births	140.	Saint Lucia	14.37 deaths/1,000 live births
96.	Belize	27.07 deaths/1,000 live births	141.	Lithuania	14.17 deaths/1,000 live births
97.	Tunisia	26.91 deaths/1,000 live births	142.	Belarus	13.87 deaths/1,000 live births
98.	Libya	26.80 deaths/1,000 live births	143.	Uruguay	13.80 deaths/1,000 live births
99.	El Salvador	26.75 deaths/1,000 live births	144.	Bulgaria	13.70 deaths/1,000 live births
100.	Lebanon	26.43 deaths/1,000 live births	145.	Brunei	13.50 deaths/1,000 live births
101.	Bahamas, The	26.21 deaths/1,000 live births	146.	Fiji	13.35 deaths/1,000 live births
102.	Korea, North	25.66 deaths/1,000 live births	148.	Jamaica	13.26 deaths/1,000 live births
103.	China	25.26 deaths/1,000 live births	149.	French Guiana	12.84 deaths/1,000 live births
104.	Philippines	24.98 deaths/1,000 live births	150.	Barbados	12.72 deaths/1,000 live births
105.	Trinidad and Tobago	24.97 deaths/1,000 live births	151.	Macedonia, FYROM	12.14 deaths/1,000 live births
106.	Suriname	24.74 deaths/1,000 live births	152.	Estonia	12.03 deaths/1,000 live births
107.	Venezuela	23.79 deaths/1,000 live births	153.	Netherlands Antilles	10.71 deaths/1,000 live births
108.	Mexico	23.68 deaths/1,000 live births	154.	Kuwait	10.57 deaths/1,000 live births
109.	Solomon Islands	22.88 deaths/1,000 live births	155.	Costa Rica	10.56 deaths/1,000 live births
110.	Anguilla	22.80 deaths/1,000 live births	156.	Nauru	10.33 deaths/1,000 live births
111.	Bosnia	22.70 deaths/1,000 live births	157.	American Samoa	9.82 deaths/1,000 live births
112.	Colombia	22.47 deaths/1,000 live births	158.	Puerto Rico	9.38 deaths/1,000 live births
113.	Thailand	21.83 deaths/1,000 live births	159.	Bermuda	9.05 deaths/1,000 live births
114.	Panama	21.44 deaths/1,000 live births	160.	Virgin Islands	9.00 deaths/1,000 live births
115.	Tuvalu	21.34 deaths/1,000 live births			
116.	Oman	21.01 deaths/1,000 live births			
117.	Antigua and Barbuda	20.90 deaths/1,000 live births			

161.	Poland	8.95 deaths/1,000 live births
162.	Chile	8.88 deaths/1,000 live births
163.	French Polynesia	8.78 deaths/1,000 live births
164.	Cayman Islands	8.64 deaths/1,000 live births
165.	Hungary	8.58 deaths/1,000 live births
166.	Slovakia	8.55 deaths/1,000 live births
167.	Reunion	8.13 deaths/1,000 live births
168.	New Caledonia	8.06 deaths/1,000 live births
169.	Cyprus	7.54 deaths/1,000 live births
170.	Israel	7.37 deaths/1,000 live births
171.	Korea, South	7.31 deaths/1,000 live births
172.	Cuba	7.15 deaths/1,000 live births
173.	Croatia	6.92 deaths/1,000 live births
174.	United States	6.75 deaths/1,000 live births
175.	Taiwan	6.65 deaths/1,000 live births
176.	Italy	6.19 deaths/1,000 live births
177.	Aruba	6.14 deaths/1,000 live births
178.	Greece	6.12 deaths/1,000 live births
179.	New Zealand	6.07 deaths/1,000 live births
180.	San Marino	5.97 deaths/1,000 live births
181.	Portugal	5.73 deaths/1,000 live births
182.	Hong Kong	5.63 deaths/1,000 live births
	Monaco	5.63 deaths/1,000 live births
184.	Malta	5.62 deaths/1,000 live births
185.	Czech Republic	5.37 deaths/1,000 live births
186.	Ireland	5.34 deaths/1,000 live births
187.	United Kingdom	5.28 deaths/1,000 live births
188.	Denmark	4.90 deaths/1,000 live births
189.	Canada	4.88 deaths/1,000 live births
190.	Liechtenstein	4.85 deaths/1,000 live births
191.	Australia	4.83 deaths/1,000 live births
192.	Luxembourg	4.65 deaths/1,000 live births
193.	Belgium	4.57 deaths/1,000 live births
194.	Spain	4.54 deaths/1,000 live births
195.	Macau	4.42 deaths/1,000 live births
	Slovenia	4.42 deaths/1,000 live births
197.	France	4.37 deaths/1,000 live births
198.	Switzerland	4.36 deaths/1,000 live births
199.	Austria	4.33 deaths/1,000 live births
200.	Netherlands	4.26 deaths/1,000 live births
201.	Germany	4.23 deaths/1,000 live births
202.	Andorra	4.06 deaths/1,000 live births
203.	Norway	3.87 deaths/1,000 live births
204.	Finland	3.73 deaths/1,000 live births
205.	Singapore	3.57 deaths/1,000 live births
206.	Iceland	3.50 deaths/1,000 live births

207.	Sweden	3.42 deaths/1,000 live births
208.	Japan	3.30 deaths/1,000 live births

#### Rankings: Life expectancy at birth, total population (All Descending)

Rank	Country	Value / Unit
1.	Andorra	83.49 years
2.	Macau	81.87 years
3.	San Marino	81.43 years
4.	Japan	80.93 years
5.	Singapore	80.42 years
6.	Australia	80.13 years
7.	Switzerland	79.99 years
8.	Sweden	79.97 years
9.	Hong Kong	79.93 years
10.	Canada	79.83 years
11.	Iceland	79.80 years
12.	Cayman Islands	79.67 years
13.	Italy	79.40 years
14.	France	79.28 years
15.	Monaco	79.27 years
16.	Liechtenstein	79.25 years
17.	Spain	79.23 years
18.	Norway	79.09 years
19.	Israel	79.02 years
20.	Greece	78.89 years
21.	Aruba	78.83 years
22.	Netherlands	78.74 years
23.	Virgin Islands	78.59 years
24.	Malta	78.43 years
25.	Germany	78.42 years
26.	New Zealand	78.32 years
27.	Belgium	78.29 years
28.	Austria	78.17 years
29.	United Kingdom	78.16 years
30.	Finland	77.92 years
31.	Jordan	77.88 years
32.	Luxembourg	77.66 years
33.	Bermuda	77.41 years
34.	Saint Helena	77.38 years
35.	Ireland	77.35 years
36.	Cyprus	77.27 years
37.	Puerto Rico	77.26 years
38.	United States	77.14 years
39.	Denmark	77.10 years
40.	Taiwan	76.87 years
41.	Cuba	76.80 years
42.	Anguilla	76.70 years
43.	French Guiana	76.69 years
44.	Kuwait	76.65 years

45.	Costa Rica	76.43 years	95.	Thailand	71.24 years
46.	Chile	76.35 years	96.	Colombia	71.14 years
	Portugal	76.35 years	97.	Brazil	71.13 years
48.	Libya	76.07 years	98.	Peru	70.88 years
49.	British Virgin Islands	76.06 years	99.	Korea, North	70.79 years
50.	Uruguay	75.87 years	100.	El Salvador	70.62 years
51.	Jamaica	75.85 years		Romania	70.62 years
52.	American Samoa	75.75 years	102.	Algeria	70.54 years
53.	Slovenia	75.51 years	103.	Egypt	70.41 years
54.	Argentina	75.48 years	104.	Estonia	70.31 years
55.	French Polynesia	75.45 years	105.	Samoa	70.11 years
56.	Netherlands Antilles	75.38 years	106.	Vietnam	70.05 years
57.	Korea, South	75.36 years	107.	Morocco	70.04 years
58.	Czech Republic	75.18 years	108.	Cape Verde	69.83 years
59.	United Arab Emirates	74.75 years	109.	Nicaragua	69.68 years
60.	Macedonia, FYROM	74.49 years	110.	Lithuania	69.60 years
61.	Slovakia	74.43 years	111.	Trinidad and Tobago	69.59 years
62.	Paraguay	74.40 years	112.	Palau	69.50 years
	Tunisia	74.40 years	113.	Marshall Islands	69.39 years
64.	Croatia	74.37 years		Syria	69.39 years
65.	Brunei	74.30 years	115.	Iran	69.35 years
66.	Dominica	74.12 years	116.	Latvia	69.31 years
67.	Serbia and Montenegro	73.97 years	117.	Philippines	69.29 years
68.	Poland	73.91 years	118.	Suriname	69.23 years
69.	Venezuela	73.81 years	119.	Micronesia, Federated States of	69.13 years
70.	Bahrain	73.72 years			69.00 years
71.	New Caledonia	73.52 years	120.	Greenland	68.94 years
72.	Reunion	73.43 years	121.	Indonesia	68.88 years
73.	Qatar	73.14 years	122.	Fiji	68.88 years
74.	Saint Lucia	73.08 years		Tonga	68.88 years
	Saint Vincent and the Grenadines	73.08 years	124.	Saudi Arabia	68.73 years
76.	Sri Lanka	72.62 years	125.	Belarus	68.43 years
77.	Oman	72.58 years	126.	Dominican Republic	67.96 years
78.	Albania	72.37 years	127.	Iraq	67.81 years
79.	Panama	72.32 years	128.	Russia	67.66 years
80.	Mexico	72.30 years	129.	Belize	67.36 years
81.	Bosnia and Herzegovina	72.29 years	130.	Tuvalu	67.32 years
82.	China	72.22 years	131.	Armenia	66.68 years
83.	Hungary	72.17 years	132.	Honduras	66.65 years
84.	Solomon Islands	72.10 years	133.	Ukraine	66.50 years
85.	Lebanon	72.07 years	134.	Sao Tome and Principe	66.28 years
86.	Ecuador	71.89 years	135.	Bahamas, The	65.71 years
87.	Barbados	71.84 years	136.	Guatemala	65.23 years
88.	Bulgaria	71.80 years	137.	East Timor	65.20 years
	Mauritius	71.80 years	138.	Moldova	64.88 years
	Turkey	71.80 years	139.	Bolivia	64.78 years
91.	Malaysia	71.67 years	140.	Georgia	64.76 years
92.	Saint Kitts and Nevis	71.57 years	141.	Grenada	64.52 years
93.	Antigua and Barbuda	71.31 years	142.	Tajikistan	64.37 years
94.	Seychelles	71.25 years	143.	Papua New Guinea	64.19 years
			144.	Uzbekistan	64.00 years

145.	Mongolia	63.81 years	195.	Sierra Leone	42.84 years
146.	Kyrgyzstan	63.66 years	196.	Namibia	42.77 years
147.	India	63.62 years	197.	Cote d'Ivoire	42.65 years
148.	Kazakhstan	63.48 years	198.	Niger	42.21 years
149.	Maldives	63.30 years	199.	Central African Republic	41.71 years
150.	Azerbaijan	63.16 years	200.	Ethiopia	41.24 years
151.	Guyana	63.09 years	201.	Swaziland	39.47 years
152.	Pakistan	62.20 years	202.	Rwanda	39.33 years
153.	Nauru	61.95 years	203.	Zimbabwe	39.01 years
154.	Vanuatu	61.71 years	204.	Malawi	37.98 years
155.	Bangladesh	61.33 years	205.	Angola	36.96 years
156.	Turkmenistan	61.19 years	206.	Lesotho	36.94 years
157.	Comoros	61.18 years	207.	Zambia	35.25 years
158.	Yemen	60.97 years	208.	Botswana	32.26 years
159.	Kiribati	60.93 years	209.	Mozambique	31.30 years
160.	Nepal	59.00 years	<b>Rankings: Life expectancy at birth, male (All Descending)</b>		
161.	Cambodia	57.92 years			
162.	Sudan	57.73 years	Rank	Country	Value / Unit
163.	Gabon	57.12 years	1.	Andorra	80.58 years
164.	Ghana	56.53 years	2.	Macau	79.05 years
165.	Senegal	56.37 years	3.	San Marino	77.90 years
166.	Madagascar	56.14 years	4.	Japan	77.63 years
167.	Burma	55.79 years	5.	Iceland	77.54 years
168.	Equatorial Guinea	54.75 years	6.	Singapore	77.46 years
169.	Gambia, The	54.38 years	7.	Sweden	77.31 years
170.	Laos	54.30 years	8.	Australia	77.27 years
171.	Bhutan	53.58 years	9.	Hong Kong	77.23 years
172.	Togo	53.43 years	10.	Switzerland	77.11 years
173.	Eritrea	53.18 years	11.	Cayman Islands	77.08 years
174.	Mauritania	51.93 years	12.	Israel	76.95 years
175.	Haiti	51.61 years	13.	Italy	76.47 years
176.	Benin	51.08 years	14.	Canada	76.44 years
177.	Nigeria	51.01 years	15.	Greece	76.32 years
178.	Congo, Republic of the	50.02 years	16.	Norway	76.15 years
179.	Guinea	49.54 years	17.	Malta	75.94 years
180.	Congo, Democratic Republic of the	48.93 years	18.	Spain	75.87 years
181.	Chad	48.51 years	19.	Netherlands	75.85 years
182.	Liberia	48.15 years	20.	United Kingdom	75.74 years
183.	Cameroon	48.05 years	21.	Kuwait	75.72 years
184.	Somalia	47.34 years	22.	France	75.63 years
185.	Afghanistan	46.97 years		Liechtenstein	75.63 years
	Guinea-Bissau	46.97 years	24.	Aruba	75.48 years
187.	South Africa	46.56 years	25.	Germany	75.46 years
188.	Mali	45.43 years	26.	Jordan	75.42 years
189.	Kenya	45.22 years	27.	Bermuda	75.38 years
190.	Uganda	44.88 years	28.	Monaco	75.37 years
191.	Tanzania	44.56 years	29.	New Zealand	75.34 years
192.	Burkina Faso	44.46 years	30.	British Virgin Islands	75.07 years
193.	Burundi	43.20 years	31.	Austria	75.02 years
194.	Djibouti	43.13 years			



32.	Belgium	74.97 years			Bosnia and Herzegovina	69.56 years
33.	Cyprus	74.94 years		83.	Albania	69.53 years
34.	Virgin Islands	74.73 years		84.	Saint Lucia	69.52 years
35.	Ireland	74.58 years		85.	Turkey	69.41 years
36.	Saint Helena	74.49 years		86.	Mexico	69.26 years
37.	Denmark	74.48 years		87.	Algeria	69.14 years
38.	Cuba	74.38 years		88.	Thailand	69.07 years
	Luxembourg	74.38 years		89.	Ecuador	69.06 years
40.	United States	74.37 years		90.	Malaysia	69.01 years
41.	Finland	74.28 years		91.	Antigua and Barbuda	68.99 years
42.	Taiwan	74.12 years		92.	Saint Kitts and Nevis	68.76 years
43.	Libya	73.91 years		93.	Peru	68.45 years
44.	Costa Rica	73.87 years		94.	Bulgaria	68.26 years
45.	Jamaica	73.84 years		95.	Syria	68.18 years
46.	Anguilla	73.79 years		96.	Korea, North	68.10 years
47.	French Guiana	73.36 years		97.	Iran	68.04 years
48.	Puerto Rico	73.27 years		98.	Tokelau	68.00 years
49.	Netherlands Antilles	73.16 years		99.	Egypt	67.94 years
50.	French Polynesia	73.08 years		100.	Hungary	67.84 years
51.	Chile	73.04 years		101.	Mauritius	67.82 years
52.	Portugal	72.86 years		102.	Morocco	67.77 years
53.	Tunisia	72.77 years		103.	Nicaragua	67.68 years
54.	Uruguay	72.54 years		104.	Vietnam	67.58 years
55.	United Arab Emirates	72.28 years		105.	Marshall Islands	67.49 years
56.	Macedonia, FYROM	72.23 years		106.	Micronesia, Federated States of	67.39 years
57.	Brunei	71.90 years				67.35 years
58.	Paraguay	71.89 years		107.	Samoa	67.29 years
59.	Korea, South	71.73 years		108.	Colombia	67.16 years
60.	Argentina	71.72 years		109.	Brazil	67.07 years
61.	Czech Republic	71.69 years		110.	Trinidad and Tobago	67.02 years
62.	Slovenia	71.65 years		111.	El Salvador	66.99 years
63.	American Samoa	71.35 years		112.	Saudi Arabia	66.88 years
64.	Saint Vincent and the Grenadines	71.30 years		113.	Romania	66.79 years
		71.28 years		114.	Suriname	66.70 years
65.	Bahrain	71.23 years		115.	Iraq	66.54 years
66.	Dominica	71.03 years		116.	Indonesia	66.53 years
67.	Serbia and Montenegro	70.78 years		117.	Cape Verde	66.44 years
68.	Venezuela	70.76 years		118.	Philippines	66.43 years
69.	Croatia	70.65 years		119.	Fiji	66.43 years
70.	Qatar	70.57 years			Tonga	66.41 years
71.	New Caledonia	70.44 years		121.	Dominican Republic	66.37 years
72.	Slovakia	70.40 years		122.	Palau	65.78 years
73.	Oman	70.33 years		123.	Seychelles	65.44 years
74.	China	70.09 years		124.	Greenland	65.31 years
75.	Sri Lanka	70.03 years		125.	Honduras	65.19 years
76.	Reunion	69.97 years		126.	Belize	65.15 years
77.	Panama	69.77 years		127.	Tuvalu	64.79 years
78.	Poland	69.64 years		128.	Sao Tome and Principe	64.36 years
79.	Lebanon	69.64 years		129.	Estonia	64.31 years
	Solomon Islands	69.56 years		130.	Guatemala	63.78 years
81.	Barbados			131.	Lithuania	

132.	Latvia	63.46 years	183.	Liberia	47.03 years
133.	East Timor	62.97 years	184.	Chad	46.97 years
134.	India	62.92 years	185.	Congo, Democratic Republic of the	46.83 years
135.	Grenada	62.74 years	186.	South Africa	46.57 years
136.	Belarus	62.54 years	187.	Somalia	45.67 years
137.	Russia	62.46 years	188.	Guinea-Bissau	45.09 years
138.	Armenia	62.41 years	189.	Kenya	45.02 years
139.	Bahamas, The	62.30 years	190.	Mali	44.70 years
140.	Bolivia	62.20 years	191.	Namibia	44.27 years
141.	Maldives	62.07 years	192.	Uganda	43.42 years
	Papua New Guinea	62.07 years	193.	Tanzania	43.33 years
143.	Mongolia	61.63 years	194.	Burkina Faso	43.02 years
144.	Bangladesh	61.46 years	195.	Burundi	42.54 years
145.	Tajikistan	61.39 years	196.	Niger	42.29 years
146.	Georgia	61.33 years	197.	Djibouti	41.82 years
147.	Pakistan	61.30 years	198.	Swaziland	41.02 years
148.	Ukraine	61.10 years	199.	Ethiopia	40.39 years
149.	Moldova	60.63 years	200.	Cote d'Ivoire	40.34 years
150.	Uzbekistan	60.53 years	201.	Sierra Leone	40.33 years
151.	Guyana	60.51 years	202.	Central African Republic	40.18 years
152.	Vanuatu	60.28 years	203.	Zimbabwe	40.09 years
153.	Kyrgyzstan	59.49 years	204.	Rwanda	38.51 years
154.	Nepal	59.36 years	205.	Malawi	37.57 years
155.	Yemen	59.16 years	206.	Lesotho	36.76 years
156.	Azerbaijan	58.95 years	207.	Angola	36.13 years
157.	Comoros	58.92 years	208.	Zambia	35.25 years
158.	Nauru	58.41 years	209.	Botswana	32.20 years
159.	Kazakhstan	58.16 years	210.	Mozambique	30.98 years
160.	Kiribati	57.97 years			
161.	Turkmenistan	57.72 years			
162.	Sudan	56.59 years			
163.	Ghana	55.66 years			
164.	Cambodia	55.49 years			
165.	Gabon	55.45 years			
166.	Senegal	54.83 years			
167.	Burma	54.12 years			
168.	Bhutan	53.90 years			
169.	Madagascar	53.82 years			
170.	Equatorial Guinea	52.63 years			
171.	Gambia, The	52.39 years			
172.	Laos	52.34 years			
173.	Eritrea	51.48 years			
174.	Togo	51.47 years			
175.	Nigeria	50.89 years			
176.	Haiti	50.36 years			
177.	Benin	50.35 years			
178.	Mauritania	49.78 years			
179.	Congo, Republic of the	49.04 years			
180.	Guinea	48.28 years			
181.	Afghanistan	47.67 years			
182.	Cameroon	47.15 years			

**Rankings: Life expectancy at birth, female  
(All Descending)**

Rank	Country	Value / Unit
1.	Andorra	86.58 years
2.	San Marino	85.26 years
3.	Macau	84.82 years
4.	Japan	84.41 years
5.	Singapore	83.60 years
6.	Canada	83.38 years
7.	Monaco	83.37 years
8.	Australia	83.13 years
9.	France	83.11 years
10.	Switzerland	83.02 years
11.	Liechtenstein	82.87 years
12.	Hong Kong	82.83 years
13.	Spain	82.80 years
14.	Sweden	82.78 years
15.	Virgin Islands	82.68 years
16.	Italy	82.52 years
17.	Aruba	82.34 years

18.	Cayman Islands	82.30 years	69.	Saint Lucia	76.90 years
19.	Iceland	82.22 years	70.	Seychelles	76.88 years
	Norway	82.22 years	71.	Brunei	76.82 years
21.	Belgium	81.78 years	72.	Hungary	76.81 years
22.	Netherlands	81.76 years	73.	New Caledonia	76.62 years
23.	Finland	81.68 years	74.	Estonia	76.57 years
24.	Greece	81.65 years	75.	Bahrain	76.24 years
25.	Germany	81.55 years	76.	Tunisia	76.15 years
26.	Austria	81.48 years	77.	Mauritius	75.85 years
27.	New Zealand	81.44 years	78.	Qatar	75.76 years
	Puerto Rico	81.44 years	79.	Lithuania	75.70 years
29.	Israel	81.19 years	80.	Bulgaria	75.56 years
30.	Luxembourg	81.15 years	81.	Mexico	75.49 years
31.	Malta	81.14 years	82.	Latvia	75.45 years
32.	United Kingdom	80.70 years	83.	Albania	75.42 years
33.	Jordan	80.50 years	84.	Brazil	75.30 years
34.	Saint Helena	80.42 years	85.	Sri Lanka	75.29 years
35.	American Samoa	80.41 years	86.	Bosnia and Herzegovina	75.22 years
36.	Ireland	80.31 years	87.	Colombia	75.12 years
37.	French Guiana	80.18 years	88.	Saint Vincent and the Grenadines	74.92 years
38.	Portugal	80.07 years			
39.	United States	80.05 years	89.	Ecuador	74.86 years
40.	Taiwan	79.88 years		Oman	74.86 years
41.	Denmark	79.87 years	91.	Panama	74.79 years
42.	Chile	79.82 years	92.	Solomon Islands	74.68 years
43.	Cyprus	79.71 years	93.	Lebanon	74.61 years
44.	Anguilla	79.70 years	94.	Belarus	74.60 years
45.	Slovenia	79.58 years	95.	Romania	74.59 years
46.	Bermuda	79.49 years	96.	Saint Kitts and Nevis	74.56 years
47.	Argentina	79.44 years	97.	Malaysia	74.51 years
48.	Uruguay	79.38 years	98.	El Salvador	74.40 years
49.	Cuba	79.36 years	99.	Turkey	74.30 years
50.	Korea, South	79.32 years	100.	China	74.28 years
51.	Costa Rica	79.11 years	101.	Barbados	74.14 years
52.	Czech Republic	78.87 years	102.	Antigua and Barbuda	73.75 years
53.	Slovakia	78.64 years	103.	Korea, North	73.61 years
54.	Libya	78.34 years	104.	Thailand	73.53 years
55.	Poland	78.28 years	105.	Peru	73.43 years
56.	Croatia	78.20 years	106.	Cape Verde	73.23 years
57.	Jamaica	77.97 years	107.	Russia	73.11 years
58.	French Polynesia	77.93 years	108.	Egypt	73.00 years
59.	Netherlands Antilles	77.70 years		Samoa	73.00 years
60.	Kuwait	77.62 years	110.	Palau	72.82 years
61.	United Arab Emirates	77.35 years	111.	Vietnam	72.70 years
62.	Serbia and Montenegro	77.16 years	112.	Greenland	72.65 years
63.	Dominica	77.15 years	113.	Morocco	72.41 years
64.	British Virgin Islands	77.10 years	114.	Philippines	72.28 years
65.	Venezuela	77.07 years	115.	Trinidad and Tobago	72.23 years
66.	Paraguay	77.03 years	116.	Ukraine	72.17 years
67.	Reunion	77.00 years	117.	Algeria	72.01 years
68.	Macedonia, FYROM	76.94 years	118.	Nicaragua	71.79 years

119.	Suriname	71.78 years	169.	Equatorial Guinea	56.93 years
120.	Indonesia	71.47 years	170.	Gambia, The	56.44 years
121.	Fiji	71.44 years	171.	Laos	56.33 years
	Tonga	71.44 years	172.	Togo	55.45 years
123.	Marshall Islands	71.40 years	173.	Eritrea	54.92 years
124.	Armenia	71.17 years	174.	Mauritania	54.13 years
125.	Micronesia, Federated States of	70.95 years	175.	Bhutan	53.25 years
		70.73 years	176.	Haiti	52.92 years
126.	Iran	70.73 years	177.	Benin	51.84 years
127.	Syria	70.67 years	178.	Nigeria	51.14 years
128.	Saudi Arabia	70.55 years	179.	Congo, Democratic Republic of the	51.09 years
129.	Tokelau	70.00 years			
130.	Belize	69.63 years	180.	Congo, Republic of the	51.02 years
131.	Tuvalu	69.59 years	181.	Guinea	50.83 years
132.	Dominican Republic	69.58 years	182.	Chad	50.10 years
133.	Moldova	69.35 years	183.	Liberia	49.30 years
134.	Bahamas, The	69.18 years	184.	Somalia	49.05 years
135.	Kazakhstan	69.06 years	185.	Cameroon	48.97 years
136.	Iraq	68.99 years	186.	Guinea-Bissau	48.91 years
137.	Georgia	68.36 years	187.	South Africa	46.54 years
138.	Honduras	68.06 years	188.	Uganda	46.38 years
139.	Kyrgyzstan	68.03 years	189.	Afghanistan	46.23 years
140.	Sao Tome and Principe	67.82 years	190.	Mali	46.19 years
141.	Uzbekistan	67.64 years	191.	Burkina Faso	45.94 years
142.	Azerbaijan	67.58 years	192.	Tanzania	45.83 years
143.	East Timor	67.55 years	193.	Kenya	45.43 years
144.	Tajikistan	67.50 years	194.	Sierra Leone	45.42 years
145.	Bolivia	67.48 years	195.	Cote d'Ivoire	45.04 years
146.	Papua New Guinea	66.42 years	196.	Djibouti	44.48 years
147.	Grenada	66.31 years	197.	Burundi	43.88 years
148.	Guatemala	66.21 years	198.	Central African Republic	43.29 years
149.	Mongolia	66.09 years	199.	Niger	42.12 years
150.	Guyana	65.79 years	200.	Ethiopia	42.11 years
151.	Nauru	65.66 years	201.	Namibia	41.22 years
152.	Turkmenistan	64.84 years	202.	Rwanda	40.18 years
153.	Maldives	64.60 years	203.	Malawi	38.39 years
154.	India	64.37 years	204.	Zimbabwe	37.89 years
155.	Kiribati	64.03 years	205.	Swaziland	37.87 years
156.	Comoros	63.50 years	206.	Angola	37.83 years
157.	Vanuatu	63.21 years	207.	Lesotho	37.13 years
158.	Pakistan	63.14 years	208.	Zambia	35.25 years
159.	Yemen	62.87 years	209.	Botswana	32.32 years
160.	Bangladesh	61.20 years	210.	Mozambique	31.63 years
161.	Cambodia	60.47 years			
162.	Sudan	58.93 years			
163.	Gabon	58.84 years			
164.	Nepal	58.63 years			
165.	Madagascar	58.53 years			
166.	Senegal	57.95 years			
167.	Burma	57.56 years			
168.	Ghana	57.43 years			

Rankings: Total fertility rate		
(All Descending)		
Rank	Country	Value / Unit
1.	Somalia	6.98 children born/woman
2.	Niger	6.91 children born/woman
3.	Yemen	6.82 children born/woman



4.	Uganda	6.72 children born/woman	50.	Kiribati	4.28 children born/woman
5.	Congo, Democratic Republic of the	6.69 children born/woman	51.	Tajikistan	4.17 children born/woman
6.	Mali	6.66 children born/woman	52.	Papua New Guinea	4.13 children born/woman
7.	Chad	6.44 children born/woman	53.	Marshall Islands	4.12 children born/woman
8.	Angola	6.38 children born/woman	54.	Pakistan	4.10 children born/woman
9.	Burkina Faso	6.34 children born/woman	55.	Honduras	4.07 children born/woman
10.	Liberia	6.23 children born/woman	56.	Paraguay	4.02 children born/woman
11.	Saudi Arabia	6.15 children born/woman	57.	Swaziland	3.92 children born/woman
12.	Malawi	6.10 children born/woman	58.	Belize	3.86 children born/woman
13.	Mauritania	6.08 children born/woman	59.	East Timor	3.79 children born/woman
14.	Benin	6.04 children born/woman	60.	Cape Verde	3.77 children born/woman
15.	Burundi	5.99 children born/woman	61.	Syria	3.72 children born/woman
16.	Oman	5.94 children born/woman	62.	Zimbabwe	3.66 children born/woman
17.	Guinea	5.90 children born/woman	63.	Congo, Republic of the	3.65 children born/woman
18.	Sao Tome and Principe	5.88 children born/woman	64.	Cambodia	3.58 children born/woman
19.	Sierra Leone	5.86 children born/woman	65.	Lesotho	3.52 children born/woman
20.	Eritrea	5.74 children born/woman	66.	Micronesia, Federated States of	3.50 children born/woman
21.	Madagascar	5.73 children born/woman		Turkmenistan	3.50 children born/woman
22.	Afghanistan	5.64 children born/woman	68.	Libya	3.49 children born/woman
23.	Rwanda	5.60 children born/woman	69.	Kenya	3.47 children born/woman
24.	Djibouti	5.56 children born/woman	70.	Nauru	3.40 children born/woman
25.	Ethiopia	5.55 children born/woman	71.	Ghana	3.32 children born/woman
26.	Gambia, The	5.53 children born/woman	72.	American Samoa	3.30 children born/woman
27.	Cote d'Ivoire	5.51 children born/woman	73.	Philippines	3.29 children born/woman
28.	Nigeria	5.40 children born/woman	74.	Botswana	3.27 children born/woman
29.	Maldives	5.26 children born/woman	75.	El Salvador	3.25 children born/woman
30.	Zambia	5.25 children born/woman	76.	Bolivia	3.23 children born/woman
31.	Tanzania	5.24 children born/woman	77.	Samoa	3.21 children born/woman
32.	Comoros	5.21 children born/woman	78.	Bangladesh	3.17 children born/woman
33.	Sudan	5.10 children born/woman	79.	Malaysia	3.13 children born/woman
34.	Guinea-Bissau	5.07 children born/woman	80.	Kyrgyzstan	3.12 children born/woman
35.	Togo	4.97 children born/woman	81.	French Guiana	3.09 children born/woman
36.	Bhutan	4.94 children born/woman		United Arab Emirates	3.09 children born/woman
37.	Laos	4.94 children born/woman	83.	Kuwait	3.08 children born/woman
38.	Senegal	4.93 children born/woman	84.	Tuvalu	3.05 children born/woman
39.	Mozambique	4.87 children born/woman	85.	Egypt	3.02 children born/woman
40.	Haiti	4.86 children born/woman		Qatar	3.02 children born/woman
41.	Gabon	4.83 children born/woman	87.	Jordan	3.00 children born/woman
42.	Equatorial Guinea	4.75 children born/woman		Nicaragua	3.00 children born/woman
43.	Namibia	4.71 children born/woman		Tonga	3.00 children born/woman
44.	Central African Republic	4.68 children born/woman		Uzbekistan	3.00 children born/woman
45.	Guatemala	4.67 children born/woman	91.	Ecuador	2.99 children born/woman
46.	Cameroon	4.63 children born/woman	92.	Vanuatu	2.98 children born/woman
47.	Iraq	4.52 children born/woman	93.	Dominican Republic	2.92 children born/woman
48.	Nepal	4.39 children born/woman			
49.	Solomon Islands	4.34 children born/woman			

94.	India	2.91 children born/woman	140.	Iceland	1.98 children born/woman
95.	Morocco	2.89 children born/woman		Lebanon	1.98 children born/woman
96.	Fiji	2.81 children born/woman		Mauritius	1.98 children born/woman
	Peru	2.81 children born/woman	143.	Saint Vincent and the Grenadines	1.95 children born/woman
98.	Bahrain	2.71 children born/woman	144.	Croatia	1.93 children born/woman
99.	Colombia	2.61 children born/woman	145.	Cayman Islands	1.91 children born/woman
100.	Algeria	2.55 children born/woman		Malta	1.91 children born/woman
101.	Mexico	2.53 children born/woman		Thailand	1.91 children born/woman
	Panama	2.53 children born/woman	148.	Bermuda	1.90 children born/woman
	Reunion	2.53 children born/woman		Sri Lanka	1.90 children born/woman
104.	Indonesia	2.50 children born/woman		Tunisia	1.90 children born/woman
	Israel	2.50 children born/woman	151.	Ireland	1.89 children born/woman
106.	Palau	2.47 children born/woman	152.	Cyprus	1.88 children born/woman
107.	Grenada	2.45 children born/woman	153.	France	1.85 children born/woman
108.	Greenland	2.43 children born/woman	154.	Norway	1.80 children born/woman
109.	Suriname	2.40 children born/woman	155.	Aruba	1.79 children born/woman
110.	New Caledonia	2.39 children born/woman		New Zealand	1.79 children born/woman
111.	Costa Rica	2.38 children born/woman		Seychelles	1.79 children born/woman
112.	Brunei	2.37 children born/woman	158.	Trinidad and Tobago	1.78 children born/woman
	Saint Kitts and Nevis	2.37 children born/woman	159.	Serbia and Montenegro	1.77 children born/woman
114.	Venezuela	2.36 children born/woman	160.	Anguilla	1.76 children born/woman
115.	Uruguay	2.35 children born/woman		Australia	1.76 children born/woman
116.	Azerbaijan	2.34 children born/woman		Monaco	1.76 children born/woman
117.	Saint Lucia	2.29 children born/woman	163.	Macedonia, FYROM	1.75 children born/woman
118.	Antigua and Barbuda	2.28 children born/woman	164.	Moldova	1.74 children born/woman
	Argentina	2.28 children born/woman	165.	Denmark	1.73 children born/woman
	Mongolia	2.28 children born/woman	166.	British Virgin Islands	1.72 children born/woman
121.	Bahamas, The	2.25 children born/woman	167.	Bosnia and Herzegovina	1.71 children born/woman
	Korea, North	2.25 children born/woman	168.	China	1.70 children born/woman
123.	South Africa	2.24 children born/woman		Finland	1.70 children born/woman
	Vietnam	2.24 children born/woman		Luxembourg	1.70 children born/woman
125.	Albania	2.22 children born/woman	171.	United Kingdom	1.66 children born/woman
	Virgin Islands	2.22 children born/woman	172.	Barbados	1.65 children born/woman
127.	Kazakhstan	2.16 children born/woman		Netherlands	1.65 children born/woman
128.	Burma	2.15 children born/woman	174.	Belgium	1.62 children born/woman
129.	French Polynesia	2.14 children born/woman	175.	Canada	1.61 children born/woman
130.	Chile	2.09 children born/woman		Cuba	1.61 children born/woman
131.	Guyana	2.07 children born/woman	177.	Taiwan	1.57 children born/woman
	United States	2.07 children born/woman	178.	Armenia	1.56 children born/woman
133.	Netherlands Antilles	2.04 children born/woman		Korea, South	1.56 children born/woman
134.	Turkey	2.03 children born/woman	180.	Saint Helena	1.54 children born/woman
135.	Puerto Rico	2.02 children born/woman		Sweden	1.54 children born/woman
136.	Brazil	2.01 children born/woman	182.	Georgia	1.51 children born/woman
	Jamaica	2.01 children born/woman			
138.	Dominica	1.99 children born/woman			
	Iran	1.99 children born/woman			

183.	Liechtenstein	1.50 children born/woman	19.	Tanzania	7.80 %
184.	Portugal	1.49 children born/woman	20.	Congo, Republic of the	7.20 %
185.	Switzerland	1.48 children born/woman	21.	Sierra Leone	7.00 %
186.	Lithuania	1.43 children born/woman	22.	Burkina Faso	6.50 %
187.	Austria	1.41 children born/woman	23.	Ethiopia	6.40 %
188.	Japan	1.38 children born/woman	24.	Haiti	6.10 %
189.	Germany	1.37 children born/woman	25.	Togo	6.00 %
	Poland	1.37 children born/woman	26.	Nigeria	5.80 %
191.	Romania	1.36 children born/woman	27.	Angola	5.50 %
192.	Greece	1.35 children born/woman	28.	Uganda	5.00 %
193.	Belarus	1.34 children born/woman	29.	Congo, Democratic Republic of the	4.90 %
	Ukraine	1.34 children born/woman			
195.	Russia	1.33 children born/woman	30.	Niger	4.00 %
196.	Hong Kong	1.32 children born/woman	31.	Benin	3.60 %
	Macau	1.32 children born/woman		Chad	3.60 %
198.	San Marino	1.31 children born/woman	33.	Bahamas, The	3.50 %
199.	Andorra	1.27 children born/woman	34.	Equatorial Guinea	3.40 %
	Estonia	1.27 children born/woman	35.	Ghana	3.00 %
	Slovenia	1.27 children born/woman	36.	Eritrea	2.80 %
202.	Italy	1.26 children born/woman		Guinea-Bissau	2.80 %
	Spain	1.26 children born/woman	38.	Cambodia	2.70 %
204.	Hungary	1.25 children born/woman		Guyana	2.70 %
	Slovakia	1.25 children born/woman	40.	Sudan	2.60 %
206.	Singapore	1.24 children born/woman	41.	Dominican Republic	2.50 %
207.	Latvia	1.20 children born/woman		Trinidad and Tobago	2.50 %
208.	Czech Republic		43.	Belize	2.00 %
		1.18 children born/woman	44.	Burma	1.99 %
209.	Bulgaria	1.13 children born/woman	45.	Mauritania	1.80 %
				Thailand	1.80 %
			47.	Mali	1.70 %
			48.	Gambia, The	1.60 %
				Honduras	1.60 %
			50.	Guinea	1.54 %
			51.	Panama	1.50 %
			52.	Barbados	1.20 %
				Jamaica	1.20 %
				Suriname	1.20 %
			55.	Estonia	1.00 %
				Guatemala	1.00 %
				Somalia	1.00 %
				Ukraine	1.00 %
			59.	Russia	0.90 %
			60.	India	0.80 %
			61.	Argentina	0.70 %
				Brazil	0.70 %
				Papua New Guinea	0.70 %
			64.	Costa Rica	0.60 %
				El Salvador	0.60 %
				United States	0.60 %
			67.	Nepal	0.50 %
				Portugal	0.50 %

**Rankings: HIV/AIDS, adult prevalence rate**  
(All Descending)

Rank	Country	Value / Unit
1.	Botswana	38.80 %
2.	Zimbabwe	33.70 %
3.	Swaziland	33.40 %
4.	Lesotho	31.00 %
5.	Namibia	22.50 %
6.	Zambia	21.50 %
7.	South Africa	20.10 %
8.	Kenya	15.00 %
	Malawi	15.00 %
10.	Mozambique	13.00 %
11.	Central African Republic	12.90 %
12.	Cameroon	11.80 %
13.	Djibouti	11.75 %
14.	Cote d'Ivoire	9.70 %
15.	Gabon	9.00 %
	Liberia	9.00 %
17.	Rwanda	8.90 %
18.	Burundi	8.30 %

	Senegal	0.50 %		Fiji	0.10 %
	Spain	0.50 %		Finland	0.10 %
	Switzerland	0.50 %		Georgia	0.10 %
	Venezuela	0.50 %		Germany	0.10 %
73.	Colombia	0.40 %		Hong Kong	0.10 %
	Italy	0.40 %		Hungary	0.10 %
	Latvia	0.40 %		Indonesia	0.10 %
	Malaysia	0.40 %		Iran	0.10 %
	Peru	0.40 %		Iraq	0.10 %
78.	Bahrain	0.30 %		Ireland	0.10 %
	Belarus	0.30 %		Israel	0.10 %
	Canada	0.30 %		Japan	0.10 %
	Chile	0.30 %		Jordan	0.10 %
	Cyprus	0.30 %		Kazakhstan	0.10 %
	Ecuador	0.30 %		Korea, South	0.10 %
	France	0.30 %		Kyrgyzstan	0.10 %
	Madagascar	0.30 %		Laos	0.10 %
	Mexico	0.30 %		Lithuania	0.10 %
	Uruguay	0.30 %		Macedonia, FYROM	0.10 %
	Vietnam	0.30 %		Maldives	0.10 %
89.	Armenia	0.20 %		Malta	0.10 %
	Austria	0.20 %		Mauritius	0.10 %
	Belgium	0.20 %		Mongolia	0.10 %
	Brunei	0.20 %		Morocco	0.10 %
	Denmark	0.20 %		New Zealand	0.10 %
	Greece	0.20 %		Oman	0.10 %
	Iceland	0.20 %		Pakistan	0.10 %
	Libya	0.20 %		Philippines	0.10 %
	Luxembourg	0.20 %		Poland	0.10 %
	Moldova	0.20 %		Romania	0.10 %
	Netherlands	0.20 %		Slovakia	0.10 %
	Nicaragua	0.20 %		Slovenia	0.10 %
	Serbia and Montenegro	0.20 %		Sri Lanka	0.10 %
	Singapore	0.20 %		Sweden	0.10 %
103.	United Arab Emirates	0.18 %		Tajikistan	0.10 %
104.	Comoros	0.12 %		Turkey	0.10 %
	Kuwait	0.12 %		Turkmenistan	0.10 %
106.	Paraguay	0.11 %		United Kingdom	0.10 %
107.	Algeria	0.10 %		Uzbekistan	0.10 %
	Australia	0.10 %		Yemen	0.10 %
	Azerbaijan	0.10 %	160.	Lebanon	0.09 %
	Bangladesh	0.10 %		Qatar	0.09 %
	Bhutan	0.10 %	162.	Cape Verde	0.04 %
	Bolivia	0.10 %		Tunisia	0.04 %
	Bosnia and Herzegovina	0.10 %	164.	Afghanistan	0.01 %
	Bulgaria	0.10 %			
	China	0.10 %			
	Croatia	0.10 %			
	Cuba	0.10 %			
	Czech Republic	0.10 %			
	Egypt	0.10 %			
<b>Rankings: Literacy, total population</b>					
<b>(All Descending)</b>					
	Rank	Country		Value / Unit	
	1.	Andorra		100.00 %	



	Australia	100.00 %		Turkmenistan	98.00 %
	Denmark	100.00 %		Uruguay	98.00 %
	Finland	100.00 %	55.	Spain	97.90 %
	Holy See (Vatican City)	100.00 %	56.	British Virgin Islands	97.80 %
	Liechtenstein	100.00 %	57.	Cyprus	97.60 %
	Luxembourg	100.00 %	58.	Greece	97.50 %
	Norway	100.00 %	59.	Barbados	97.40 %
9.	Czech Republic	99.90 %	60.	Maldives	97.20 %
	Iceland	99.90 %	61.	Argentina	97.10 %
11.	Estonia	99.80 %	62.	American Samoa	97.00 %
	Latvia	99.80 %		Aruba	97.00 %
	Poland	99.80 %		Azerbaijan	97.00 %
14.	Samoa	99.70 %		Canada	97.00 %
	Slovenia	99.70 %		Cuba	97.00 %
	Ukraine	99.70 %		Kyrgyzstan	97.00 %
17.	Belarus	99.60 %		Saint Helena	97.00 %
	Lithuania	99.60 %		Saint Kitts and Nevis	97.00 %
	Russia	99.60 %		United States	97.00 %
20.	Hungary	99.40 %	71.	Netherlands Antilles	96.70 %
	Tajikistan	99.40 %	72.	Chile	96.20 %
22.	Uzbekistan	99.30 %	73.	Costa Rica	96.00 %
23.	Moldova	99.10 %		Saint Vincent and the Grenadines	96.00 %
	Mongolia	99.10 %			
25.	France	99.00 %		San Marino	96.00 %
	Georgia	99.00 %		Thailand	96.00 %
	Germany	99.00 %	77.	Philippines	95.90 %
	Japan	99.00 %	78.	Bahamas, The	95.60 %
	Korea, North	99.00 %	79.	Israel	95.40 %
	Monaco	99.00 %	80.	Anguilla	95.00 %
	Netherlands	99.00 %		Niue	95.00 %
	New Zealand	99.00 %	82.	Macau	94.50 %
	Sweden	99.00 %	83.	Belize	94.10 %
	Switzerland	99.00 %	84.	Dominica	94.00 %
	United Kingdom	99.00 %		Hong Kong	94.00 %
36.	Guyana	98.80 %		Paraguay	94.00 %
37.	Armenia	98.60 %		Vietnam	94.00 %
	Bulgaria	98.60 %	88.	Puerto Rico	93.80 %
	Italy	98.60 %	89.	Fiji	93.70 %
	Trinidad and Tobago	98.60 %		Marshall Islands	93.70 %
41.	Croatia	98.50 %	91.	Venezuela	93.40 %
	Tonga	98.50 %	92.	Portugal	93.30 %
43.	Kazakhstan	98.40 %	93.	Singapore	93.20 %
	Romania	98.40 %	94.	Serbia and Montenegro	93.00 %
45.	Korea, South	98.10 %		Suriname	93.00 %
46.	Austria	98.00 %	96.	Malta	92.80 %
	Belgium	98.00 %	97.	Panama	92.60 %
	Bermuda	98.00 %	98.	Colombia	92.50 %
	Cayman Islands	98.00 %		Ecuador	92.50 %
	French Polynesia	98.00 %	100.	Sri Lanka	92.30 %
	Grenada	98.00 %	101.	Mexico	92.20 %
	Ireland	98.00 %	102.	Palau	92.00 %

103.	Brunei	91.80 %	153.	Algeria	70.00 %
104.	Jordan	91.30 %	154.	Cambodia	69.90 %
105.	New Caledonia	91.00 %		Uganda	69.90 %
106.	Peru	90.90 %	156.	Madagascar	68.90 %
107.	Zimbabwe	90.70 %	157.	Nigeria	68.00 %
108.	Bahrain	89.10 %	158.	Djibouti	67.90 %
109.	Antigua and Barbuda	89.00 %	159.	Nicaragua	67.50 %
	Micronesia, Federated States of	89.00 %	160.	Saint Lucia	67.00 %
111.	Malaysia	88.90 %	161.	Papua New Guinea	66.00 %
	Reunion	88.90 %	162.	Congo, Democratic Republic of the	65.50 %
113.	Indonesia	88.50 %	163.	Gabon	63.20 %
114.	Jamaica	87.90 %	164.	Malawi	62.70 %
115.	Lebanon	87.40 %	165.	Sudan	61.10 %
116.	Bolivia	87.20 %	166.	Togo	60.90 %
117.	Albania	86.50 %	167.	India	59.50 %
	Turkey	86.50 %	168.	Eritrea	58.60 %
119.	Brazil	86.40 %	169.	Seychelles	58.00 %
	South Africa	86.40 %	170.	Egypt	57.70 %
121.	China	86.00 %	171.	Liberia	57.50 %
	Taiwan	86.00 %	172.	Comoros	56.50 %
123.	Equatorial Guinea	85.70 %	173.	Vanuatu	53.00 %
124.	Mauritius	85.60 %	174.	Haiti	52.90 %
125.	Kenya	85.10 %	175.	Laos	52.80 %
126.	Lesotho	84.80 %	176.	Morocco	51.70 %
127.	Dominican Republic	84.70 %	177.	Burundi	51.60 %
128.	Namibia	84.00 %	178.	Central African Republic	51.00 %
129.	Congo, Republic of the	83.80 %	179.	Cote d'Ivoire	50.90 %
130.	Kuwait	83.50 %	180.	Yemen	50.20 %
131.	Burma	83.10 %	181.	East Timor	48.00 %
132.	French Guiana	83.00 %	182.	Mozambique	47.80 %
133.	Libya	82.60 %	183.	Chad	47.50 %
134.	Qatar	82.50 %	184.	Mali	46.40 %
135.	Swaziland	81.60 %	185.	Pakistan	45.70 %
136.	Zambia	80.60 %	186.	Nepal	45.20 %
137.	El Salvador	80.20 %	187.	Bangladesh	43.10 %
138.	Botswana	79.80 %	188.	Ethiopia	42.70 %
139.	Iran	79.40 %	189.	Guinea-Bissau	42.40 %
140.	Sao Tome and Principe	79.30 %	190.	Bhutan	42.20 %
141.	Cameroon	79.00 %	191.	Angola	42.00 %
142.	Saudi Arabia	78.80 %	192.	Mauritania	41.70 %
143.	Tanzania	78.20 %	193.	Benin	40.90 %
144.	United Arab Emirates	77.90 %	194.	Iraq	40.40 %
145.	Syria	76.90 %	195.	Senegal	40.20 %
146.	Cape Verde	76.60 %	196.	Gambia, The	40.10 %
147.	Honduras	76.20 %	197.	Somalia	37.80 %
148.	Oman	75.80 %	198.	Afghanistan	36.00 %
149.	Ghana	74.80 %	199.	Guinea	35.90 %
150.	Tunisia	74.20 %	200.	Sierra Leone	31.40 %
151.	Guatemala	70.60 %	201.	Burkina Faso	26.60 %
152.	Rwanda	70.40 %	202.	Niger	17.60 %

**Rankings: GDP, purchasing power parity  
(All Descending)**

Rank	Country	Value / Unit			
1.	United States	10,450,000,000,000 \$	49.	Finland	133,800,000,000 \$
2.	China	5,989,000,000,000 \$	50.	Venezuela	131,700,000,000 \$
3.	Japan	3,651,000,000,000 \$	51.	Morocco	121,800,000,000 \$
4.	India	2,664,000,000,000 \$	52.	Kazakhstan	120,000,000,000 \$
5.	Germany	2,160,000,000,000 \$	53.	Israel	117,400,000,000 \$
6.	France	1,558,000,000,000 \$	54.	Ireland	113,700,000,000 \$
7.	United Kingdom	1,528,000,000,000 \$	55.	Nigeria	112,500,000,000 \$
8.	Italy	1,455,000,000,000 \$	56.	Singapore	112,400,000,000 \$
9.	Russia	1,409,000,000,000 \$	57.	Belarus	90,190,000,000 \$
10.	Brazil	1,376,000,000,000 \$	58.	New Zealand	78,400,000,000 \$
11.	Korea, South	941,500,000,000 \$	59.	Sri Lanka	73,700,000,000 \$
12.	Canada	934,100,000,000 \$	60.	Burma	73,690,000,000 \$
13.	Mexico	924,400,000,000 \$	61.	Slovakia	67,340,000,000 \$
14.	Spain	850,700,000,000 \$	62.	Tunisia	67,130,000,000 \$
15.	Indonesia	714,200,000,000 \$	63.	Uzbekistan	66,060,000,000 \$
16.	Australia	525,500,000,000 \$	64.	Syria	63,480,000,000 \$
17.	Turkey	489,700,000,000 \$	65.	Iraq	58,000,000,000 \$
18.	Iran	458,300,000,000 \$	66.	United Arab Emirates	53,970,000,000 \$
19.	Thailand	445,800,000,000 \$	67.	Dominican Republic	53,780,000,000 \$
20.	Netherlands	437,800,000,000 \$	68.	Guatemala	53,200,000,000 \$
21.	South Africa	427,700,000,000 \$	69.	Sudan	52,900,000,000 \$
22.	Taiwan	406,000,000,000 \$	70.	Bulgaria	49,230,000,000 \$
23.	Argentina	403,800,000,000 \$	71.	Ethiopia	48,530,000,000 \$
24.	Philippines	379,700,000,000 \$	72.	Croatia	43,120,000,000 \$
25.	Poland	373,200,000,000 \$	73.	Puerto Rico	43,010,000,000 \$
26.	Belgium	299,700,000,000 \$	74.	Ecuador	42,650,000,000 \$
27.	Pakistan	295,300,000,000 \$	75.	Ghana	41,250,000,000 \$
28.	Egypt	289,800,000,000 \$	76.	Nepal	37,320,000,000 \$
29.	Saudi Arabia	268,900,000,000 \$	77.	Slovenia	37,060,000,000 \$
30.	Colombia	251,600,000,000 \$	78.	Kuwait	36,850,000,000 \$
31.	Bangladesh	238,200,000,000 \$	79.	Congo, Democratic Republic of the	34,000,000,000 \$
32.	Switzerland	233,400,000,000 \$	80.	Libya	33,360,000,000 \$
33.	Sweden	230,700,000,000 \$	81.	Kenya	32,890,000,000 \$
34.	Austria	227,700,000,000 \$	82.	Costa Rica	32,000,000,000 \$
35.	Ukraine	218,000,000,000 \$	83.	Turkmenistan	31,340,000,000 \$
36.	Greece	203,300,000,000 \$	84.	Cuba	30,690,000,000 \$
37.	Hong Kong	198,500,000,000 \$	85.	Uganda	30,490,000,000 \$
38.	Malaysia	198,400,000,000 \$	86.	Lithuania	30,080,000,000 \$
39.	Portugal	195,200,000,000 \$	87.	El Salvador	29,410,000,000 \$
40.	Vietnam	183,800,000,000 \$	88.	Azerbaijan	28,610,000,000 \$
41.	Algeria	173,800,000,000 \$	89.	Cameroon	26,840,000,000 \$
42.	Romania	169,300,000,000 \$	90.	Uruguay	26,820,000,000 \$
43.	Czech Republic	157,100,000,000 \$	91.	Zimbabwe	26,070,000,000 \$
44.	Chile	156,100,000,000 \$	92.	Paraguay	25,190,000,000 \$
45.	Denmark	155,300,000,000 \$	93.	Cote d'Ivoire	24,030,000,000 \$
46.	Norway	149,100,000,000 \$	94.	Serbia and Montenegro	23,150,000,000 \$
47.	Peru	138,800,000,000 \$	95.	Jordan	22,630,000,000 \$
48.	Hungary	134,000,000,000 \$	96.	Oman	22,400,000,000 \$
			97.	Korea, North	22,260,000,000 \$
			98.	Luxembourg	21,940,000,000 \$

99.	Bolivia	21,150,000,000 \$	150.	Mongolia	5,060,000,000 \$
100.	Latvia	20,990,000,000 \$	151.	Mauritania	4,891,000,000 \$
101.	Cambodia	20,420,000,000 \$	152.	Fiji	4,822,000,000 \$
	Tanzania	20,420,000,000 \$	153.	Bahamas, The	4,590,000,000 \$
103.	Mozambique	19,520,000,000 \$	154.	Central African Republic	4,296,000,000 \$
104.	Afghanistan	19,000,000,000 \$	155.	Somalia	4,270,000,000 \$
105.	Guinea	18,690,000,000 \$	156.	Reunion	4,174,000,000 \$
106.	Angola	18,360,000,000 \$	157.	Barbados	4,153,000,000 \$
107.	Panama	18,060,000,000 \$	158.	Eritrea	3,300,000,000 \$
108.	Lebanon	17,610,000,000 \$	159.	Burundi	3,146,000,000 \$
109.	Honduras	16,290,000,000 \$	160.	Liberia	3,116,000,000 \$
110.	Georgia	16,050,000,000 \$	161.	New Caledonia	3,000,000,000 \$
111.	Qatar	15,910,000,000 \$	162.	Sierra Leone	2,826,000,000 \$
112.	Albania	15,690,000,000 \$	163.	Bhutan	2,700,000,000 \$
113.	Senegal	15,640,000,000 \$	164.	Guyana	2,628,000,000 \$
114.	Estonia	15,520,000,000 \$	165.	Gambia, The	2,582,000,000 \$
115.	Yemen	15,070,000,000 \$	166.	Congo, Republic of the	2,500,000,000 \$
116.	Burkina Faso	14,510,000,000 \$	167.	Netherlands Antilles	2,400,000,000 \$
117.	Kyrgyzstan	13,880,000,000 \$		Virgin Islands	2,400,000,000 \$
118.	Botswana	13,480,000,000 \$	169.	French Guiana	2,260,000,000 \$
119.	Namibia	13,150,000,000 \$	170.	Bermuda	2,250,000,000 \$
120.	Madagascar	12,590,000,000 \$	171.	Aruba	1,940,000,000 \$
121.	Mauritius	12,150,000,000 \$	172.	Suriname	1,469,000,000 \$
122.	Armenia	12,130,000,000 \$	173.	Andorra	1,300,000,000 \$
123.	Moldova	11,510,000,000 \$		French Polynesia	1,300,000,000 \$
124.	Nicaragua	11,160,000,000 \$	175.	Belize	1,280,000,000 \$
125.	Trinidad and Tobago	11,070,000,000 \$	176.	Cayman Islands	1,270,000,000 \$
126.	Papua New Guinea	10,860,000,000 \$		Equatorial Guinea	1,270,000,000 \$
127.	Haiti	10,600,000,000 \$	178.	Maldives	1,250,000,000 \$
128.	Macedonia, FYROM	10,570,000,000 \$	179.	Greenland	1,100,000,000 \$
129.	Laos	10,400,000,000 \$	180.	Samoa	1,000,000,000 \$
130.	Jamaica	10,080,000,000 \$	181.	San Marino	940,000,000 \$
131.	Bahrain	9,910,000,000 \$	182.	Guinea-Bissau	901,400,000 \$
132.	Mali	9,775,000,000 \$	183.	Monaco	870,000,000 \$
133.	Cyprus	9,400,000,000 \$	184.	Saint Lucia	866,000,000 \$
134.	Chad	9,297,000,000 \$	185.	Liechtenstein	825,000,000 \$
135.	Rwanda	8,920,000,000 \$	186.	Solomon Islands	800,000,000 \$
136.	Niger	8,713,000,000 \$	187.	Antigua and Barbuda	750,000,000 \$
137.	Macau	8,600,000,000 \$	188.	Seychelles	626,000,000 \$
138.	Tajikistan	8,476,000,000 \$	189.	Djibouti	619,000,000 \$
139.	Iceland	8,444,000,000 \$	190.	Cape Verde	600,000,000 \$
140.	Gabon	8,354,000,000 \$	191.	Vanuatu	563,000,000 \$
141.	Zambia	8,240,000,000 \$	192.	American Samoa	500,000,000 \$
142.	Togo	7,594,000,000 \$	193.	Comoros	441,000,000 \$
143.	Benin	7,380,000,000 \$	194.	East Timor	440,000,000 \$
144.	Bosnia and Herzegovina	7,300,000,000 \$		Grenada	440,000,000 \$
145.	Malta	6,818,000,000 \$	196.	Dominica	380,000,000 \$
146.	Malawi	6,811,000,000 \$	197.	Saint Kitts and Nevis	339,000,000 \$
147.	Brunei	6,500,000,000 \$		Saint Vincent and the Grenadines	339,000,000 \$
148.	Swaziland	5,542,000,000 \$			
149.	Lesotho	5,106,000,000 \$	199.	British Virgin Islands	320,000,000 \$



200.	Micronesia, Federated States of	277,000,000 \$	32.	Uganda	5.50 %
201.	Tonga	236,000,000 \$	33.	Georgia	5.40 %
202.	Sao Tome and Principe	200,000,000 \$	34.	Burma	5.30 %
203.	Palau	174,000,000 \$		Kyrgyzstan	5.30 %
204.	Marshall Islands	115,000,000 \$		Peru	5.30 %
205.	Anguilla	104,000,000 \$	38.	Thailand	5.30 %
206.	Kiribati	79,000,000 \$	39.	Croatia	5.20 %
207.	Falkland Islands (Islas Malvinas)	75,000,000 \$	40.	Sudan	5.10 %
208.	Nauru	60,000,000 \$	41.	Samoa	5.00 %
209.	Saint Helena	18,000,000 \$	43.	Jordan	4.90 %
210.	Tuvalu	12,200,000 \$		Romania	4.90 %
211.	Niue	7,600,000 \$		Bangladesh	4.80 %
212.	Tokelau	1,500,000 \$		Bulgaria	4.80 %
				Tunisia	4.80 %
				Ukraine	4.80 %
			47.	Belarus	4.70 %
			48.	Burkina Faso	4.60 %
				Fiji	4.60 %
				Morocco	4.60 %
				Qatar	4.60 %
			52.	Burundi	4.50 %
				Cambodia	4.50 %
				Ghana	4.50 %
				Mali	4.50 %
			56.	Pakistan	4.40 %
				Philippines	4.40 %
				Slovakia	4.40 %
			59.	India	4.30 %
				Russia	4.30 %
			61.	Botswana	4.20 %
				Uzbekistan	4.20 %
			63.	Dominican Republic	4.10 %
				Malaysia	4.10 %
				Yemen	4.10 %
			66.	Cameroon	4.00 %
				Cape Verde	4.00 %
				French Polynesia	4.00 %
				Greece	4.00 %
				Lesotho	4.00 %
				Sao Tome and Principe	4.00 %
				Serbia and Montenegro	4.00 %
			73.	Mongolia	3.90 %
			74.	Andorra	3.80 %
			75.	Belize	3.70 %
				Guinea	3.70 %
				Indonesia	3.70 %
			78.	Australia	3.60 %
				Syria	3.60 %
			80.	Congo, Democratic Republic of the	3.50 %
				Djibouti	3.50 %

### Rankings: GDP, real growth rate

(All Descending)

Rank	Country	Value / Unit
1.	Turkmenistan	21.10 %
2.	Equatorial Guinea	20.00 %
3.	East Timor	18.00 %
4.	Armenia	12.90 %
5.	Liechtenstein	11.00 %
6.	Azerbaijan	10.60 %
7.	Rwanda	9.70 %
8.	Kazakhstan	9.50 %
	Macau	9.50 %
10.	Angola	9.40 %
11.	Tajikistan	9.10 %
12.	China	8.00 %
13.	Turkey	7.80 %
14.	Bhutan	7.70 %
	Mozambique	7.70 %
16.	Iran	7.60 %
17.	San Marino	7.50 %
18.	Chad	7.40 %
19.	Albania	7.30 %
20.	Vietnam	7.00 %
21.	Ireland	6.90 %
22.	Lithuania	6.70 %
23.	Sierra Leone	6.60 %
24.	Moldova	6.50 %
25.	Korea, South	6.30 %
26.	Latvia	6.10 %
	Tanzania	6.10 %
28.	Benin	6.00 %
	Estonia	6.00 %
30.	Gambia, The	5.70 %
	Laos	5.70 %

	Somalia	3.50 %		United Arab Emirates	1.80 %
	Taiwan	3.50 %		United Kingdom	1.80 %
84.	Ecuador	3.40 %	135.	Cayman Islands	1.70 %
85.	Algeria	3.30 %		Cyprus	1.70 %
	Canada	3.30 %		Malawi	1.70 %
	Hungary	3.30 %	138.	Denmark	1.60 %
	Mauritania	3.30 %		Finland	1.60 %
	New Zealand	3.30 %		Swaziland	1.60 %
	Saint Lucia	3.30 %	141.	Brazil	1.50 %
91.	Egypt	3.20 %		Central African Republic	1.50 %
	Nigeria	3.20 %		Colombia	1.50 %
	Slovenia	3.20 %		Kiribati	1.50 %
	Sri Lanka	3.20 %		Seychelles	1.50 %
	Trinidad and Tobago	3.20 %	146.	Poland	1.40 %
96.	Antigua and Barbuda	3.00 %	147.	Dominica	1.20 %
	Brunei	3.00 %		France	1.20 %
	Ethiopia	3.00 %		Libya	1.20 %
	South Africa	3.00 %		Malta	1.20 %
	Tonga	3.00 %		Suriname	1.20 %
	Tuvalu	3.00 %	152.	Austria	1.10 %
102.	Bahrain	2.90 %		Cuba	1.10 %
	Niger	2.90 %		Guyana	1.10 %
	Togo	2.90 %		Kenya	1.10 %
105.	Anguilla	2.80 %		Nicaragua	1.10 %
	Bolivia	2.80 %	157.	British Virgin Islands	1.00 %
	Costa Rica	2.80 %		Jamaica	1.00 %
108.	Grenada	2.50 %		Korea, North	1.00 %
	Honduras	2.50 %		Marshall Islands	1.00 %
	Reunion	2.50 %		Micronesia, Federated States of	1.00 %
111.	Senegal	2.40 %		Norway	1.00 %
	United States	2.40 %		Palau	1.00 %
113.	Bosnia and Herzegovina	2.30 %		Saudi Arabia	1.00 %
	Hong Kong	2.30 %	165.	Belgium	0.70 %
	Maldives	2.30 %		Macedonia, FYROM	0.70 %
	Mauritius	2.30 %		Mexico	0.70 %
	Namibia	2.30 %		Panama	0.70 %
	Zambia	2.30 %	169.	Bermuda	0.50 %
119.	Guatemala	2.20 %	170.	Italy	0.40 %
	Oman	2.20 %		Luxembourg	0.40 %
	Singapore	2.20 %		Portugal	0.40 %
122.	Chile	2.10 %	173.	Gabon	0.20 %
	El Salvador	2.10 %		Germany	0.20 %
124.	Comoros	2.00 %		Japan	0.20 %
	Czech Republic	2.00 %		Netherlands	0.20 %
	Eritrea	2.00 %	177.	Bahamas, The	0.10 %
	Lebanon	2.00 %		Switzerland	0.10 %
	Liberia	2.00 %	179.	Congo, Republic of the	0.00 %
	Spain	2.00 %		Netherlands Antilles	0.00 %
	Virgin Islands	2.00 %	181.	Puerto Rico	-0.20 %
131.	Sweden	1.90 %	182.	Niue	-0.30 %
132.	Greenland	1.80 %			

184.	Vanuatu	-0.30 %	23.	Solomon Islands	42.00 %
	Saint Vincent and the Grenadines	-0.50 %	25.	Togo	42.00 %
185.	Iceland	-0.60 %		Cambodia	40.00 %
	Nepal	-0.60 %		Comoros	40.00 %
187.	Israel	-0.80 %	28.	Nepal	40.00 %
188.	Haiti	-0.90 %	29.	Niger	39.00 %
189.	Aruba	-1.50 %		Benin	38.00 %
190.	Cote d'Ivoire	-1.60 %		Chad	38.00 %
191.	Saint Kitts and Nevis	-1.90 %	31.	Malawi	37.00 %
192.	Kuwait	-2.00 %	32.	Ghana	36.00 %
193.	Paraguay	-2.70 %		Uzbekistan	36.00 %
194.	Barbados	-2.80 %	34.	Bangladesh	35.00 %
195.	Iraq	-3.00 %		Burkina Faso	35.00 %
196.	Papua New Guinea	-3.10 %		Guyana	35.00 %
197.	Guinea-Bissau	-4.30 %		Kyrgyzstan	35.00 %
198.	Venezuela	-8.90 %	38.	Gambia, The	33.00 %
199.	Solomon Islands	-10.00 %	39.	Papua New Guinea	32.10 %
200.	Uruguay	-10.80 %	40.	Mongolia	32.00 %
201.	Argentina	-10.90 %	41.	Korea, North	30.40 %
202.	Madagascar	-11.90 %	42.	Armenia	30.00 %
203.	Zimbabwe	-13.00 %		Haiti	30.00 %
<b>Rankings: GDP, composition by sector (agriculture)</b>				Kiribati	30.00 %
<b>(All Descending)</b>				Nicaragua	30.00 %
Rank	Country	Value / Unit	46.	Cote d'Ivoire	29.00 %
1.	Liberia	74.00 %	47.	Moldova	28.00 %
2.	Somalia	65.00 %	48.	Paraguay	27.00 %
3.	Guinea-Bissau	62.00 %		Syria	27.00 %
4.	Afghanistan	60.00 %		Turkmenistan	27.00 %
	Burma	60.00 %	51.	Serbia and Montenegro	26.00 %
	Kuwait	60.00 %		Tonga	26.00 %
7.	Central African Republic	55.00 %		Vanuatu	26.00 %
	Congo, Democratic Republic of the	55.00 %	54.	East Timor	25.40 %
9.	Laos	53.00 %	55.	Guinea	25.00 %
10.	Ethiopia	52.00 %		India	25.00 %
11.	Burundi	50.00 %		Madagascar	25.00 %
	Micronesia, Federated States of	50.00 %		Mauritania	25.00 %
13.	Albania	49.00 %		Sao Tome and Principe	25.00 %
	Sierra Leone	49.00 %	60.	Kenya	24.00 %
15.	Tanzania	48.10 %		Pakistan	24.00 %
16.	Cameroon	46.00 %		Vietnam	24.00 %
17.	Bhutan	45.00 %	63.	Guatemala	23.00 %
	Mali	45.00 %		Ukraine	23.00 %
	Nigeria	45.00 %	65.	Mozambique	22.00 %
	Rwanda	45.00 %		Yemen	22.00 %
21.	Sudan	43.00 %		Zambia	22.00 %
	Uganda	43.00 %	68.	Azerbaijan	20.00 %
				Bolivia	20.00 %
				Equatorial Guinea	20.00 %
				Georgia	20.00 %
				Lesotho	20.00 %
				Maldives	20.00 %

	Sri Lanka	20.00 %		New Zealand	8.00 %
75.	Iran	19.00 %		Reunion	8.00 %
	Tajikistan	19.00 %	126.	Grenada	7.70 %
77.	Belize	18.00 %	127.	Cuba	7.60 %
	Dominica	18.00 %	128.	Panama	7.00 %
	Senegal	18.00 %		Saint Lucia	7.00 %
	Zimbabwe	18.00 %	130.	Barbados	6.00 %
81.	Egypt	17.00 %		French Polynesia	6.00 %
	Eritrea	17.00 %		Iraq	6.00 %
	Fiji	17.00 %		Jamaica	6.00 %
	Indonesia	17.00 %		Mauritius	6.00 %
	Swaziland	17.00 %		Uruguay	6.00 %
86.	China	15.20 %	136.	Estonia	5.80 %
87.	Belarus	15.00 %		Russia	5.80 %
	Gabon	15.00 %	138.	Saudi Arabia	5.20 %
	Morocco	15.00 %	139.	Argentina	5.00 %
	Philippines	15.00 %		Brunei	5.00 %
	Romania	15.00 %		Ireland	5.00 %
92.	Honduras	14.00 %		Mexico	5.00 %
	Iceland	14.00 %		New Caledonia	5.00 %
	Marshall Islands	14.00 %		Venezuela	5.00 %
	Samoa	14.00 %	145.	Cyprus	4.60 %
96.	Bulgaria	13.70 %	146.	Latvia	4.50 %
97.	Bosnia and Herzegovina	13.00 %		Slovakia	4.50 %
	Colombia	13.00 %	148.	Korea, South	4.40 %
	Suriname	13.00 %		South Africa	4.40 %
100.	Turkey	12.90 %	150.	Hungary	4.10 %
101.	Lebanon	12.00 %	151.	Anguilla	4.00 %
	Malaysia	12.00 %		Botswana	4.00 %
	Tunisia	12.00 %		Finland	4.00 %
104.	Cape Verde	11.00 %		Spain	4.00 %
	Chile	11.00 %	155.	Antigua and Barbuda	3.90 %
	Dominican Republic	11.00 %	156.	Czech Republic	3.80 %
	Ecuador	11.00 %		Poland	3.80 %
	Macedonia, FYROM	11.00 %	158.	Jordan	3.70 %
	Namibia	11.00 %	159.	Portugal	3.60 %
	Thailand	11.00 %	160.	Djibouti	3.50 %
111.	Congo, Republic of the	10.00 %		Saint Kitts and Nevis	3.50 %
	El Salvador	10.00 %	162.	Slovenia	3.20 %
	Peru	10.00 %	163.	Netherlands	3.10 %
	Saint Vincent and the Grenadines	10.00 %	164.	Australia	3.00 %
				Bahamas, The	3.00 %
115.	Costa Rica	9.00 %		Denmark	3.00 %
	Croatia	9.00 %		France	3.00 %
	Kazakhstan	9.00 %		Israel	3.00 %
	Libya	9.00 %		Oman	3.00 %
119.	Greece	8.10 %		United Arab Emirates	3.00 %
120.	Algeria	8.00 %	171.	Malta	2.80 %
	Angola	8.00 %	172.	Italy	2.40 %
	Brazil	8.00 %		Seychelles	2.40 %
	Lithuania	8.00 %	174.	Canada	2.30 %



175.	Austria	2.00 %	26.	Belarus	40.00 %
	Sweden	2.00 %		Kazakhstan	40.00 %
	Switzerland	2.00 %		Liechtenstein	40.00 %
	Taiwan	2.00 %		Malaysia	40.00 %
	United States	2.00 %		Thailand	40.00 %
180.	Norway	1.90 %	31.	Kuwait	39.70 %
181.	British Virgin Islands	1.80 %	32.	Yemen	38.00 %
182.	Trinidad and Tobago	1.60 %	33.	Guinea	37.00 %
183.	Cayman Islands	1.40 %		Vietnam	37.00 %
	Japan	1.40 %	35.	Slovenia	36.30 %
	United Kingdom	1.40 %	36.	Brazil	36.00 %
186.	Belgium	1.30 %		Serbia and Montenegro	36.00 %
187.	Bahrain	1.00 %	38.	Papua New Guinea	35.80 %
	Bermuda	1.00 %	39.	Bahrain	35.00 %
	Germany	1.00 %		Poland	35.00 %
	Luxembourg	1.00 %		Romania	35.00 %
	Macau	1.00 %	42.	Russia	34.60 %
	Netherlands Antilles	1.00 %	43.	Cuba	34.50 %
	Puerto Rico	1.00 %	44.	Slovakia	34.10 %
194.	Qatar	0.40 %	45.	Chile	34.00 %
195.	Hong Kong	0.10 %		Dominican Republic	34.00 %
				Egypt	34.00 %
				Finland	34.00 %
				Switzerland	34.00 %
			50.	Hungary	33.80 %
			51.	Austria	33.00 %
				Azerbaijan	33.00 %
				Croatia	33.00 %
				Ecuador	33.00 %
				Mauritius	33.00 %
				Morocco	33.00 %
				Singapore	33.00 %
			58.	Korea, North	32.30 %
			59.	Honduras	32.00 %
				Tunisia	32.00 %
			61.	Germany	31.00 %
				Jamaica	31.00 %
				Lithuania	31.00 %
				Macedonia, FYROM	31.00 %
				Philippines	31.00 %
				Sierra Leone	31.00 %
				Spain	31.00 %
				Taiwan	31.00 %
			69.	Japan	30.90 %
			70.	Norway	30.80 %
			71.	Turkey	30.40 %
			72.	Colombia	30.00 %
				Costa Rica	30.00 %
				El Salvador	30.00 %
				Israel	30.00 %
				Italy	30.00 %

**Rankings: GDP, composition by sector (industry)**  
(All Descending)

Rank	Country	Value / Unit
1.	Qatar	67.60 %
2.	Angola	67.00 %
3.	Algeria	60.00 %
	Equatorial Guinea	60.00 %
	Gabon	60.00 %
6.	Oman	55.00 %
7.	China	51.20 %
	Saudi Arabia	51.20 %
9.	Turkmenistan	50.00 %
	Venezuela	50.00 %
11.	Congo, Republic of the	48.00 %
12.	Ireland	46.00 %
	Lesotho	46.00 %
	United Arab Emirates	46.00 %
15.	Brunei	45.00 %
	Libya	45.00 %
	Puerto Rico	45.00 %
18.	Botswana	44.00 %
	Swaziland	44.00 %
20.	Trinidad and Tobago	43.20 %
21.	Ukraine	42.00 %
22.	Korea, South	41.60 %
23.	Czech Republic	41.00 %
	Indonesia	41.00 %
25.	Bosnia and Herzegovina	40.90 %

	Luxembourg	30.00 %		New Zealand	23.00 %
	New Caledonia	30.00 %		Samoa	23.00 %
79.	Eritrea	29.00 %		Syria	23.00 %
	Mauritania	29.00 %	130.	Greece	22.30 %
	Sweden	29.00 %	131.	Cote d'Ivoire	22.00 %
82.	South Africa	28.90 %		Suriname	22.00 %
83.	Portugal	28.70 %	133.	Cameroon	21.00 %
84.	Estonia	28.60 %		Guyana	21.00 %
85.	Bulgaria	28.50 %		Iceland	21.00 %
86.	Argentina	28.00 %		Lebanon	21.00 %
	Namibia	28.00 %		Togo	21.00 %
88.	Albania	27.00 %		Uzbekistan	21.00 %
	Paraguay	27.00 %	139.	Afghanistan	20.00 %
	Peru	27.00 %		Bolivia	20.00 %
	Senegal	27.00 %		Cambodia	20.00 %
	Uruguay	27.00 %		Central African Republic	20.00 %
93.	Canada	26.50 %		Guatemala	20.00 %
94.	Armenia	26.00 %		Haiti	20.00 %
	Australia	26.00 %		Nepal	20.00 %
	Denmark	26.00 %		Nigeria	20.00 %
	France	26.00 %		Rwanda	20.00 %
	Iran	26.00 %		Saint Lucia	20.00 %
	Jordan	26.00 %	149.	Cyprus	19.90 %
	Latvia	26.00 %	150.	Antigua and Barbuda	19.20 %
	Mexico	26.00 %	151.	Bangladesh	19.00 %
	Nicaragua	26.00 %		Burundi	19.00 %
	Saint Vincent and the Grenadines	26.00 %		Reunion	19.00 %
	Sri Lanka	26.00 %		Uganda	19.00 %
	Tajikistan	26.00 %	155.	Anguilla	18.00 %
	Zambia	26.00 %		French Polynesia	18.00 %
107.	Saint Kitts and Nevis	25.80 %		Maldives	18.00 %
108.	Netherlands	25.70 %		United States	18.00 %
109.	Malta	25.50 %	159.	East Timor	17.20 %
110.	Fiji	25.00 %	160.	Burkina Faso	17.00 %
	Georgia	25.00 %		Cape Verde	17.00 %
	Ghana	25.00 %		Mali	17.00 %
	India	25.00 %		Niger	17.00 %
	Kyrgyzstan	25.00 %		Panama	17.00 %
	Pakistan	25.00 %		Sudan	17.00 %
116.	United Kingdom	24.90 %	166.	Barbados	16.00 %
117.	Belgium	24.40 %		Malawi	16.00 %
	Seychelles	24.40 %		Marshall Islands	16.00 %
119.	Belize	24.00 %	169.	Djibouti	15.80 %
	Dominica	24.00 %	170.	Tanzania	15.40 %
	Zimbabwe	24.00 %	171.	Benin	15.00 %
122.	Grenada	23.90 %		Netherlands Antilles	15.00 %
123.	Laos	23.00 %	173.	Hong Kong	13.40 %
	Moldova	23.00 %	174.	Chad	13.00 %
	Mongolia	23.00 %		Gambia, The	13.00 %
	Mozambique	23.00 %		Iraq	13.00 %
				Kenya	13.00 %

178.	Guinea-Bissau	12.00 %	25.	Australia	71.00 %
	Macau	12.00 %		Denmark	71.00 %
	Madagascar	12.00 %		France	71.00 %
	Tonga	12.00 %	28.	Saint Kitts and Nevis	70.70 %
	Vanuatu	12.00 %	29.	Jordan	70.30 %
183.	Congo, Democratic Republic of the		30.	Marshall Islands	70.00 %
		11.00 %	31.	Latvia	69.50 %
	Ethiopia	11.00 %	32.	Greece	69.30 %
	Solomon Islands	11.00 %	33.	Luxembourg	69.00 %
186.	Bermuda	10.00 %		Mexico	69.00 %
	Bhutan	10.00 %		New Zealand	69.00 %
	Sao Tome and Principe	10.00 %		Sweden	69.00 %
	Somalia	10.00 %	37.	Grenada	68.40 %
190.	Burma	9.00 %	38.	Germany	68.00 %
191.	Bahamas, The	7.00 %	39.	Japan	67.70 %
	Kiribati	7.00 %		Portugal	67.70 %
	Liberia	7.00 %	41.	Italy	67.60 %
194.	British Virgin Islands	6.20 %	42.	Norway	67.30 %
195.	Comoros	4.00 %	43.	Israel	67.00 %
	Micronesia, Federated States of			Lebanon	67.00 %
		4.00 %		Singapore	67.00 %
197.	Cayman Islands	3.20 %		Taiwan	67.00 %
				Uruguay	67.00 %
			48.	South Africa	66.70 %
			49.	Argentina	66.00 %
			50.	Estonia	65.60 %
			51.	Austria	65.00 %
				Iceland	65.00 %
				New Caledonia	65.00 %
				Sao Tome and Principe	65.00 %
				Spain	65.00 %
				Suriname	65.00 %
			57.	Bahrain	64.00 %
				Saint Vincent and the Grenadines	64.00 %
				Switzerland	64.00 %
			60.	Jamaica	63.00 %
				Kenya	63.00 %
				Kiribati	63.00 %
				Madagascar	63.00 %
				Peru	63.00 %
				Samoa	63.00 %
			66.	Hungary	62.10 %
			67.	Finland	62.00 %
				Maldives	62.00 %
				Tonga	62.00 %
				Vanuatu	62.00 %
			71.	Slovakia	61.40 %
			72.	Poland	61.20 %
			73.	Costa Rica	61.00 %
				Lithuania	61.00 %

**Rankings: GDP, composition by sector (services)**  
(All Descending)

Rank	Country	Value / Unit
1.	Cayman Islands	95.40 %
2.	British Virgin Islands	92.00 %
3.	Bahamas, The	90.00 %
4.	Bermuda	89.00 %
5.	Macau	87.00 %
6.	Hong Kong	86.50 %
7.	Netherlands Antilles	84.00 %
8.	Iraq	81.00 %
9.	Djibouti	80.70 %
10.	United States	80.00 %
11.	Anguilla	78.00 %
	Barbados	78.00 %
13.	Antigua and Barbuda	76.80 %
14.	French Polynesia	76.00 %
	Panama	76.00 %
16.	Belgium	74.30 %
17.	United Kingdom	73.70 %
18.	Seychelles	73.20 %
19.	Reunion	73.00 %
	Saint Lucia	73.00 %
21.	Cape Verde	72.00 %
22.	Malta	71.70 %
23.	Canada	71.20 %
	Netherlands	71.20 %

	Mauritius	61.00 %	125.	Chad	49.00 %
	Namibia	61.00 %		Cote d'Ivoire	49.00 %
77.	Slovenia	60.50 %		Egypt	49.00 %
78.	Bolivia	60.00 %		Ireland	49.00 %
	El Salvador	60.00 %		Moldova	49.00 %
80.	Russia	59.60 %		Thailand	49.00 %
81.	Belize	58.00 %	131.	Burkina Faso	48.00 %
	Croatia	58.00 %		Malaysia	48.00 %
	Dominica	58.00 %	133.	Azerbaijan	47.00 %
	Fiji	58.00 %		Benin	47.00 %
	Macedonia, FYROM			Malawi	47.00 %
		58.00 %		Solomon Islands	47.00 %
	Zimbabwe	58.00 %	137.	Bosnia and Herzegovina	46.10 %
87.	Bulgaria	57.90 %	138.	Bangladesh	46.00 %
	Cuba	57.90 %		Libya	46.00 %
89.	East Timor	57.40 %		Mauritania	46.00 %
90.	Colombia	57.00 %		Micronesia, Federated States of	
	Guatemala	57.00 %			46.00 %
92.	Turkey	56.70 %		Paraguay	46.00 %
93.	Brazil	56.00 %	143.	Belarus	45.00 %
	Chile	56.00 %		Bhutan	45.00 %
	Comoros	56.00 %		Mongolia	45.00 %
	Ecuador	56.00 %		Venezuela	45.00 %
	Tunisia	56.00 %	147.	Armenia	44.00 %
98.	Czech Republic	55.20 %		Guyana	44.00 %
	Trinidad and Tobago	55.20 %		Nicaragua	44.00 %
100.	Dominican Republic	55.00 %		Niger	44.00 %
	Georgia	55.00 %	151.	Saudi Arabia	43.60 %
	Iran	55.00 %	152.	Uzbekistan	43.00 %
	Mozambique	55.00 %	153.	Congo, Republic of the	42.00 %
	Niue	55.00 %		Indonesia	42.00 %
	Senegal	55.00 %		Oman	42.00 %
	Tajikistan	55.00 %	156.	Cambodia	40.00 %
107.	Eritrea	54.00 %		Kyrgyzstan	40.00 %
	Gambia, The	54.00 %		Nepal	40.00 %
	Honduras	54.00 %		Sudan	40.00 %
	Korea, South	54.00 %		Western Sahara	40.00 %
	Philippines	54.00 %		Yemen	40.00 %
	Puerto Rico	54.00 %	162.	Ghana	39.00 %
	Sri Lanka	54.00 %		Swaziland	39.00 %
114.	Botswana	52.00 %		Vietnam	39.00 %
	Morocco	52.00 %	165.	Guinea	38.00 %
	Zambia	52.00 %		Mali	38.00 %
117.	Kazakhstan	51.00 %		Serbia and Montenegro	38.00 %
	Pakistan	51.00 %		Uganda	38.00 %
	United Arab Emirates	51.00 %	169.	Korea, North	37.30 %
120.	Brunei	50.00 %	170.	Ethiopia	37.00 %
	Haiti	50.00 %		Togo	37.00 %
	India	50.00 %	172.	Tanzania	36.50 %
	Romania	50.00 %	173.	Nigeria	35.00 %
	Syria	50.00 %		Rwanda	35.00 %



176.	Ukraine	35.00 %	23.	Kyrgyzstan	55.00 %
	Congo, Democratic Republic of the	34.00 %		Georgia	54.00 %
	Lesotho	34.00 %		Malawi	54.00 %
178.	China	33.60 %	26.	Senegal	54.00 %
179.	Cameroon	33.00 %		Eritrea	53.00 %
180.	Papua New Guinea	32.10 %	28.	Honduras	53.00 %
181.	Algeria	32.00 %		Armenia	50.00 %
	Qatar	32.00 %		Djibouti	50.00 %
183.	Myanmar	31.00 %		Kenya	50.00 %
	Burundi	31.00 %		Mauritania	50.00 %
185.	Guinea-Bissau	26.00 %		Namibia	50.00 %
186.	Angola	25.00 %		Nicaragua	50.00 %
	Central African Republic	25.00 %		Peru	50.00 %
	Gabon	25.00 %	36.	South Africa	50.00 %
	Somalia	25.00 %		Azerbaijan	49.00 %
190.	Albania	24.00 %	38.	Lesotho	49.00 %
	Laos	24.00 %		Cameroon	48.00 %
192.	Turkmenistan	23.00 %	40.	El Salvador	48.00 %
193.	Sierra Leone	21.00 %		Botswana	47.00 %
194.	Afghanistan	20.00 %	42.	Venezuela	47.00 %
	Equatorial Guinea	20.00 %		Burkina Faso	45.00 %
196.	Cyprus	19.90 %	44.	Ethiopia	45.00 %
197.	Liberia	19.00 %	45.	Romania	44.50 %
198.	Kuwait	0.30 %		East Timor	42.00 %
				Nepal	42.00 %
			47.	Guinea	40.00 %
				Iran	40.00 %
				Laos	40.00 %
				Mexico	40.00 %
				Philippines	40.00 %
				Swaziland	40.00 %
			53.	Argentina	37.00 %
				Benin	37.00 %
				Cote d'Ivoire	37.00 %
				Panama	37.00 %
				Papua New Guinea	37.00 %
				Vietnam	37.00 %
			59.	Cambodia	36.00 %
				Mongolia	36.00 %
				Paraguay	36.00 %
				Tanzania	36.00 %
			63.	Bangladesh	35.60 %
			64.	Pakistan	35.00 %
				Uganda	35.00 %
			66.	Turkmenistan	34.40 %
			67.	Jamaica	34.20 %
			68.	Belize	33.00 %
			69.	Grenada	32.00 %
				Togo	32.00 %
			71.	Ghana	31.40 %
			72.	Albania	30.00 %

### Rankings: Population below poverty line

(All Descending)

Rank	Country	Value / Unit			
1.	Zambia	86.00 %			
2.	Chad	80.00 %	53.		
	Haiti	80.00 %			
	Liberia	80.00 %			
	Moldova	80.00 %			
6.	Guatemala	75.00 %			
7.	Madagascar	71.00 %			
8.	Bolivia	70.00 %	59.		
	Burundi	70.00 %			
	Ecuador	70.00 %			
	Mozambique	70.00 %			
	Suriname	70.00 %	63.		
	Zimbabwe	70.00 %	64.		
14.	Sierra Leone	68.00 %			
15.	Mali	64.00 %	66.		
16.	Niger	63.00 %	67.		
17.	Comoros	60.00 %	68.		
	Nigeria	60.00 %	69.		
	Rwanda	60.00 %			
	Tajikistan	60.00 %	71.		
21.	Colombia	55.00 %	72.		

	Cape Verde	30.00 %	7.	Japan	67,700,000
	Dominica	30.00 %	8.	Nigeria	66,000,000
	Jordan	30.00 %	9.	Bangladesh	64,100,000
	Serbia and Montenegro	30.00 %	10.	Germany	41,900,000
77.	Ukraine	29.00 %	11.	Pakistan	40,400,000
78.	Lebanon	28.00 %	12.	Mexico	39,800,000
79.	Indonesia	27.00 %	13.	Vietnam	38,200,000
80.	Micronesia, Federated States of	26.70 %	14.	Philippines	33,700,000
81.	Kazakhstan	26.00 %	15.	Thailand	33,400,000
82.	Fiji	25.50 %	16.	United Kingdom	29,700,000
83.	Burma	25.00 %	17.	France	26,600,000
	Dominican Republic	25.00 %	18.	Turkey	23,800,000
	India	25.00 %	19.	Burma	23,700,000
	Russia	25.00 %	20.	Italy	23,600,000
87.	Macedonia, FYROM	24.00 %	21.	Ukraine	22,800,000
88.	Algeria	23.00 %	22.	Korea, South	22,000,000
89.	Egypt	22.90 %	23.	Iran	21,000,000
90.	Belarus	22.00 %	24.	Egypt	20,600,000
	Brazil	22.00 %	25.	Colombia	18,300,000
	Sri Lanka	22.00 %	26.	Poland	17,600,000
93.	Chile	21.00 %	27.	Spain	17,100,000
	Trinidad and Tobago	21.00 %	28.	South Africa	17,000,000
95.	Costa Rica	20.60 %	29.	Canada	16,400,000
96.	Morocco	19.00 %	30.	Argentina	15,000,000
97.	Poland	18.40 %	31.	Congo, Democratic Republic of the	14,510,000
98.	Israel	18.00 %	32.	Tanzania	13,495,000
99.	United Kingdom	17.00 %	33.	Uganda	12,000,000
100.	Syria	15.00 %	34.	Uzbekistan	11,900,000
101.	United States	12.70 %	35.	Morocco	11,000,000
102.	Bulgaria	12.60 %		Sudan	11,000,000
103.	Thailand	12.50 %	37.	Afghanistan	10,000,000
104.	China	10.00 %		Kenya	10,000,000
	Ireland	10.00 %		Nepal	10,000,000
	Mauritius	10.00 %		Taiwan	10,000,000
107.	Hungary	8.60 %	41.	Malaysia	9,900,000
108.	Malaysia	8.00 %		Romania	9,900,000
109.	France	6.40 %		Venezuela	9,900,000
110.	Tunisia	6.00 %	44.	Korea, North	9,600,000
	Uruguay	6.00 %	45.	Algeria	9,400,000
			46.	Australia	9,200,000
				Mozambique	9,200,000
			48.	Ghana	9,000,000
			49.	Kazakhstan	8,400,000
			50.	Peru	7,500,000
			51.	Madagascar	7,300,000
			52.	Netherlands	7,200,000
			53.	Saudi Arabia	7,000,000
			54.	Sri Lanka	6,600,000
			55.	Iraq	6,500,000
			56.	Cambodia	6,000,000

Rankings: Labor force (All Descending)		
Rank	Country	Value / Unit
1.	China	744,000,000
2.	India	406,000,000
3.	United States	141,800,000
4.	Indonesia	99,000,000
5.	Brazil	79,000,000
6.	Russia	71,800,000

57.	Chile	5,900,000	108.	Croatia	1,700,000
58.	Zimbabwe	5,800,000		Moldova	1,700,000
59.	Czech Republic	5,203,000		Nicaragua	1,700,000
60.	Syria	5,200,000	111.	United Arab Emirates	1,600,000
61.	Portugal	5,100,000	112.	Lebanon	1,500,000
62.	Angola	5,000,000		Libya	1,500,000
	Burkina Faso	5,000,000		Lithuania	1,500,000
64.	Belarus	4,800,000	115.	Armenia	1,400,000
65.	Rwanda	4,600,000		Mongolia	1,400,000
66.	Malawi	4,500,000	117.	Sierra Leone	1,369,000
67.	Belgium	4,440,000	118.	Jordan	1,360,000
68.	Sweden	4,400,000	119.	Kuwait	1,300,000
69.	Greece	4,370,000		Puerto Rico	1,300,000
70.	Austria	4,300,000	121.	Albania	1,283,000
	Cuba	4,300,000	122.	Uruguay	1,200,000
72.	Zambia	4,290,000	123.	Jamaica	1,130,000
73.	Guatemala	4,200,000	124.	Latvia	1,100,000
	Hungary	4,200,000		Macedonia, FYROM	1,100,000
75.	Switzerland	4,000,000		Panama	1,100,000
76.	Mali	3,930,000	127.	Bosnia and Herzegovina	1,026,000
77.	Bulgaria	3,830,000	128.	Oman	920,000
78.	Azerbaijan	3,700,000	129.	Slovenia	857,400
	Burundi	3,700,000	130.	Lesotho	838,000
	Ecuador	3,700,000	131.	Mauritania	786,000
	Somalia	3,700,000	132.	Namibia	725,000
82.	Haiti	3,600,000	133.	Estonia	608,600
83.	Hong Kong	3,520,000	134.	Gabon	600,000
84.	Tajikistan	3,187,000	135.	Trinidad and Tobago	564,000
85.	Guinea	3,000,000	136.	Mauritius	514,000
	Serbia and Montenegro	3,000,000	137.	Guinea-Bissau	480,000
	Slovakia	3,000,000	138.	Guyana	418,000
88.	Denmark	2,856,000	139.	Gambia, The	400,000
89.	Kyrgyzstan	2,700,000	140.	Swaziland	383,200
90.	Tunisia	2,690,000	141.	Reunion	309,900
91.	Finland	2,600,000	142.	Bahrain	295,000
92.	Bolivia	2,500,000	143.	Cyprus	291,000
	Israel	2,500,000	144.	Djibouti	282,000
94.	Laos	2,400,000	145.	Qatar	280,122
	Norway	2,400,000	146.	Botswana	264,000
96.	El Salvador	2,350,000	147.	Luxembourg	262,300
97.	Turkmenistan	2,340,000	148.	Macau	214,000
98.	Dominican Republic	2,300,000	149.	Malta	160,000
	Honduras	2,300,000	150.	Iceland	159,000
	Papua New Guinea	2,300,000	151.	Bahamas, The	156,000
101.	Singapore	2,190,000	152.	Comoros	144,500
102.	Georgia	2,100,000	153.	Brunei	143,400
103.	Paraguay	2,000,000	154.	Fiji	137,000
104.	New Zealand	1,920,000	155.	Barbados	128,500
105.	Costa Rica	1,900,000	156.	Suriname	100,000
106.	Ireland	1,800,000	157.	Belize	90,000
107.	Togo	1,740,000		Samoa	90,000

159.	Netherlands Antilles	89,000			Kenya	40.00 %
160.	Maldives	88,000			Tajikistan	40.00 %
161.	New Caledonia	79,395	13.		Macedonia, FYROM	37.00 %
162.	French Polynesia	70,000			South Africa	37.00 %
	Niger	70,000	15.		Reunion	36.00 %
164.	Saint Vincent and the Grenadines		16.		Namibia	35.00 %
		67,000	17.		Swaziland	34.00 %
165.	French Guiana	58,800	18.		Serbia and Montenegro	32.00 %
166.	Virgin Islands	49,000	19.		Algeria	31.00 %
167.	Saint Lucia	43,800	20.		Marshall Islands	30.90 %
168.	Grenada	42,300	21.		Cameroon	30.00 %
169.	Aruba	41,501			Equatorial Guinea	30.00 %
170.	Bermuda	37,472			Libya	30.00 %
171.	Tonga	33,908			Yemen	30.00 %
172.	Andorra	33,000	25.		Honduras	28.00 %
173.	Seychelles	30,900			Nigeria	28.00 %
174.	Monaco	30,540	27.		Saudi Arabia	25.00 %
175.	Antigua and Barbuda	30,000			Vietnam	25.00 %
176.	Liechtenstein	29,000	29.		Nicaragua	24.00 %
177.	Marshall Islands	28,698	30.		Dominica	23.00 %
178.	Solomon Islands	26,842	31.		French Guiana	22.00 %
179.	Dominica	25,000			Saint Vincent and the Grenadines	
180.	Greenland	24,500				22.00 %
181.	Cayman Islands	19,820	33.		Croatia	21.70 %
182.	San Marino	18,500	34.		Argentina	21.50 %
183.	Saint Kitts and Nevis	18,172	35.		Cape Verde	21.00 %
184.	American Samoa	14,000			Gabon	21.00 %
185.	Western Sahara	12,000			Mauritania	21.00 %
186.	Palau	9,845			Mozambique	21.00 %
187.	Kiribati	7,870	39.		Armenia	20.00 %
188.	Tuvalu	7,000			Comoros	20.00 %
189.	Anguilla	6,049			Ghana	20.00 %
190.	British Virgin Islands	4,911			Mongolia	20.00 %
191.	Saint Helena	3,500			Syria	20.00 %
192.	Falkland Islands (Islas Malvinas)		44.		Uruguay	19.40 %
		1,100	45.		Morocco	19.00 %
					New Caledonia	19.00 %
			47.		Sudan	18.70 %
			48.		Paraguay	18.20 %
			49.		Poland	18.10 %
			50.		Bulgaria	18.00 %
					Lebanon	18.00 %
			52.		Colombia	17.40 %
			53.		Slovakia	17.20 %
			54.		Albania	17.00 %
					Georgia	17.00 %
					Suriname	17.00 %
					Venezuela	17.00 %
			58.		Saint Lucia	16.50 %
			59.		Iran	16.30 %
			60.		Azerbaijan	16.00 %

Rankings: Unemployment rate (All Descending)					
Rank	Country	Value / Unit			
1.	Zimbabwe	70.00 %			
2.	Djibouti	50.00 %			
	East Timor	50.00 %			
	Zambia	50.00 %			
5.	Senegal	48.00 %			
6.	Nepal	47.00 %			
7.	Lesotho	45.00 %			
8.	Bangladesh	40.00 %			
	Bosnia and Herzegovina	40.00 %			
	Botswana	40.00 %			



	Jordan	16.00 %	111.	Pakistan	7.80 %
	Micronesia, Federated States of	16.00 %	112.	Ecuador	7.70 %
		16.00 %	113.	Bolivia	7.60 %
	Panama	16.00 %		Canada	7.60 %
64.	Jamaica	15.40 %		Fiji	7.60 %
	Tunisia	15.40 %		Latvia	7.60 %
66.	Bahrain	15.00 %	117.	Guatemala	7.50 %
	Netherlands Antilles	15.00 %		Hong Kong	7.50 %
68.	Mali	14.60 %	119.	Belgium	7.20 %
69.	Dominican Republic	14.50 %		Kyrgyzstan	7.20 %
70.	Saint Helena	14.00 %	121.	Kuwait	7.00 %
71.	Tonga	13.30 %		Malta	7.00 %
72.	Cote d'Ivoire	13.00 %	123.	Bahamas, The	6.90 %
73.	Grenada	12.50 %	124.	Anguilla	6.70 %
	Lithuania	12.50 %	125.	Brazil	6.40 %
75.	Estonia	12.40 %	126.	Australia	6.30 %
76.	Egypt	12.00 %		Costa Rica	6.30 %
	Puerto Rico	12.00 %		Macau	6.30 %
78.	French Polynesia	11.80 %	129.	American Samoa	6.00 %
79.	Spain	11.30 %	130.	Madagascar	5.90 %
80.	Antigua and Barbuda	11.00 %	131.	Hungary	5.80 %
	Slovenia	11.00 %		United States	5.80 %
82.	Trinidad and Tobago	10.80 %	133.	Laos	5.70 %
	Turkey	10.80 %	134.	Japan	5.40 %
84.	Indonesia	10.60 %	135.	New Zealand	5.30 %
85.	Israel	10.40 %	136.	Taiwan	5.20 %
86.	Greece	10.30 %		United Kingdom	5.20 %
87.	Philippines	10.20 %	138.	Myanmar	5.10 %
88.	Barbados	10.00 %		Denmark	5.10 %
	Brunei	10.00 %	140.	Virgin Islands	4.90 %
	China	10.00 %	141.	Austria	4.80 %
	El Salvador	10.00 %	142.	Portugal	4.70 %
	Greenland	10.00 %	143.	Singapore	4.60 %
	Uzbekistan	10.00 %	144.	Bermuda	4.50 %
94.	Czech Republic	9.80 %		Saint Kitts and Nevis	4.50 %
	Germany	9.80 %	146.	Ireland	4.30 %
96.	Peru	9.40 %	147.	Cayman Islands	4.10 %
97.	Chile	9.20 %		Cuba	4.10 %
98.	Belize	9.10 %		Luxembourg	4.10 %
	France	9.10 %	150.	Sweden	4.00 %
	Guyana	9.10 %	151.	Norway	3.90 %
	Italy	9.10 %	152.	Malaysia	3.80 %
102.	India	8.80 %		Ukraine	3.80 %
	Kazakhstan	8.80 %	154.	Cyprus	3.30 %
	Mauritius	8.80 %	155.	Korea, South	3.10 %
105.	Finland	8.50 %		Monaco	3.10 %
106.	Romania	8.30 %	157.	British Virgin Islands	3.00 %
107.	Central African Republic	8.00 %		Mexico	3.00 %
	Moldova	8.00 %		Netherlands	3.00 %
	Sri Lanka	8.00 %	160.	Thailand	2.90 %
110.	Russia	7.90 %	161.	Cambodia	2.80 %

	Iceland	2.80 %
163.	Qatar	2.70 %
164.	San Marino	2.60 %
165.	Palau	2.30 %
166.	Belarus	2.10 %
167.	Kiribati	2.00 %
168.	Switzerland	1.90 %
169.	Liechtenstein	1.30 %
170.	Aruba	0.60 %
171.	Andorra	0.00 %
	Nauru	0.00 %

### Rankings: Exports (All Descending)

Rank	Country	Value / Unit
1.	United States	687,000,000,000 \$
2.	Germany	608,000,000,000 \$
3.	Japan	383,800,000,000 \$
4.	China	325,600,000,000 \$
5.	France	307,800,000,000 \$
6.	United Kingdom	286,300,000,000 \$
7.	Canada	260,500,000,000 \$
8.	Italy	259,200,000,000 \$
9.	Netherlands	243,300,000,000 \$
10.	Hong Kong	200,300,000,000 \$
11.	Korea, South	162,600,000,000 \$
12.	Belgium	162,000,000,000 \$
13.	Mexico	158,400,000,000 \$
14.	Taiwan	130,000,000,000 \$
15.	Singapore	127,000,000,000 \$
16.	Spain	122,200,000,000 \$
17.	Russia	104,600,000,000 \$
18.	Switzerland	100,300,000,000 \$
19.	Malaysia	95,200,000,000 \$
20.	Ireland	86,600,000,000 \$
21.	Sweden	80,600,000,000 \$
22.	Saudi Arabia	71,000,000,000 \$
23.	Austria	70,000,000,000 \$
24.	Norway	68,200,000,000 \$
25.	Thailand	67,700,000,000 \$
26.	Australia	66,300,000,000 \$
27.	Brazil	59,400,000,000 \$
28.	Denmark	56,300,000,000 \$
29.	Indonesia	52,300,000,000 \$
30.	Puerto Rico	46,900,000,000 \$
31.	United Arab Emirates	44,900,000,000 \$
32.	India	44,500,000,000 \$
33.	Czech Republic	40,800,000,000 \$
34.	Finland	40,100,000,000 \$
35.	Philippines	35,100,000,000 \$

	Turkey	35,100,000,000 \$
37.	Poland	32,400,000,000 \$
38.	South Africa	31,800,000,000 \$
39.	Hungary	31,400,000,000 \$
40.	Venezuela	28,600,000,000 \$
41.	Israel	28,100,000,000 \$
42.	Portugal	25,900,000,000 \$
43.	Argentina	25,300,000,000 \$
44.	Iran	24,800,000,000 \$
45.	Algeria	19,500,000,000 \$
46.	Ukraine	18,100,000,000 \$
47.	Chile	17,800,000,000 \$
48.	Nigeria	17,300,000,000 \$
49.	Vietnam	16,500,000,000 \$
50.	Kuwait	16,000,000,000 \$
51.	New Zealand	15,000,000,000 \$
52.	Romania	13,700,000,000 \$
53.	Iraq	13,000,000,000 \$
54.	Colombia	12,900,000,000 \$
	Slovakia	12,900,000,000 \$
56.	Greece	12,600,000,000 \$
57.	Libya	11,800,000,000 \$
58.	Qatar	10,900,000,000 \$
59.	Oman	10,600,000,000 \$
60.	Kazakhstan	10,300,000,000 \$
	Slovenia	10,300,000,000 \$
62.	Luxembourg	10,100,000,000 \$
63.	Pakistan	9,800,000,000 \$
64.	Angola	8,600,000,000 \$
65.	Belarus	7,700,000,000 \$
66.	Peru	7,600,000,000 \$
67.	Morocco	7,500,000,000 \$
68.	Egypt	7,000,000,000 \$
69.	Tunisia	6,800,000,000 \$
70.	Bangladesh	6,200,000,000 \$
	Syria	6,200,000,000 \$
72.	Bahrain	5,800,000,000 \$
	Panama	5,800,000,000 \$
74.	Lithuania	5,400,000,000 \$
75.	Bulgaria	5,300,000,000 \$
	Dominican Republic	5,300,000,000 \$
77.	Costa Rica	5,100,000,000 \$
78.	Croatia	4,900,000,000 \$
	Ecuador	4,900,000,000 \$
80.	Sri Lanka	4,600,000,000 \$
81.	Cote d'Ivoire	4,400,000,000 \$
82.	Trinidad and Tobago	4,200,000,000 \$
83.	Estonia	3,400,000,000 \$
	Yemen	3,400,000,000 \$
85.	Brunei	3,000,000,000 \$
	El Salvador	3,000,000,000 \$

87.	Turkmenistan	2,970,000,000 \$	134.	Mali	680,000,000 \$
88.	Uzbekistan	2,800,000,000 \$		Mozambique	680,000,000 \$
89.	Burma	2,700,000,000 \$	136.	Nicaragua	637,000,000 \$
	Guatemala	2,700,000,000 \$	137.	Moldova	590,000,000 \$
91.	Gabon	2,600,000,000 \$	138.	Bahamas, The	560,700,000 \$
92.	Equatorial Guinea	2,500,000,000 \$	139.	Netherlands Antilles	553,000,000 \$
	Jordan	2,500,000,000 \$	140.	Armenia	525,000,000 \$
94.	Liechtenstein	2,470,000,000 \$	141.	Georgia	515,000,000 \$
95.	Botswana	2,400,000,000 \$	142.	Mongolia	501,000,000 \$
	Congo, Republic of the	2,400,000,000 \$	143.	Guyana	500,000,000 \$
	Serbia and Montenegro	2,400,000,000 \$	144.	Kyrgyzstan	488,000,000 \$
		2,400,000,000 \$	145.	Uganda	476,000,000 \$
98.	Macau	2,360,000,000 \$	146.	Togo	449,000,000 \$
99.	Iceland	2,300,000,000 \$	147.	Suriname	445,000,000 \$
	Latvia	2,300,000,000 \$	148.	Fiji	442,000,000 \$
101.	Ghana	2,200,000,000 \$	149.	Malawi	435,000,000 \$
102.	Kenya	2,100,000,000 \$	150.	Ethiopia	433,000,000 \$
	Uruguay	2,100,000,000 \$	151.	Lesotho	422,000,000 \$
104.	Azerbaijan	2,000,000,000 \$	152.	New Caledonia	400,000,000 \$
	Malta	2,000,000,000 \$	153.	Greenland	364,000,000 \$
	Paraguay	2,000,000,000 \$	154.	Mauritania	355,000,000 \$
107.	Cameroon	1,900,000,000 \$	155.	American Samoa	345,000,000 \$
108.	Aruba	1,880,000,000 \$		Laos	345,000,000 \$
109.	Cuba	1,800,000,000 \$	157.	Albania	340,000,000 \$
	Papua New Guinea	1,800,000,000 \$	158.	Haiti	298,000,000 \$
	Sudan	1,800,000,000 \$	159.	Niger	293,000,000 \$
112.	Mauritius	1,600,000,000 \$	160.	Belize	290,000,000 \$
113.	Zimbabwe	1,570,000,000 \$	161.	French Polynesia	260,000,000 \$
114.	Jamaica	1,400,000,000 \$	162.	Burkina Faso	250,000,000 \$
115.	Cambodia	1,380,000,000 \$	163.	Seychelles	235,000,000 \$
116.	Bolivia	1,300,000,000 \$	164.	Barbados	227,000,000 \$
	Honduras	1,300,000,000 \$	165.	Reunion	214,000,000 \$
118.	Namibia	1,210,000,000 \$	166.	Benin	207,000,000 \$
119.	Afghanistan	1,200,000,000 \$	167.	Chad	197,000,000 \$
	Congo, Democratic Republic of the	1,200,000,000 \$	168.	French Guiana	155,000,000 \$
		1,200,000,000 \$	169.	Bhutan	154,000,000 \$
121.	Bosnia and Herzegovina	1,150,000,000 \$	170.	Gambia, The	138,000,000 \$
		1,150,000,000 \$	171.	Central African Republic	134,000,000 \$
	Senegal	1,150,000,000 \$			126,000,000 \$
123.	Macedonia, FYROM	1,100,000,000 \$	172.	Somalia	126,000,000 \$
124.	Cyprus	1,030,000,000 \$	173.	Liberia	110,000,000 \$
125.	Lebanon	1,000,000,000 \$		Maldives	110,000,000 \$
126.	Tanzania	863,000,000 \$	175.	Grenada	78,000,000 \$
127.	Korea, North	842,000,000 \$	176.	Guinea-Bissau	71,000,000 \$
128.	Guinea	835,000,000 \$	177.	Djibouti	70,000,000 \$
129.	Swaziland	820,000,000 \$	178.	Saint Lucia	68,300,000 \$
130.	Nepal	720,000,000 \$	179.	Rwanda	68,000,000 \$
131.	Tajikistan	710,000,000 \$	180.	Andorra	58,000,000 \$
132.	Zambia	709,000,000 \$	181.	Saint Vincent and the Grenadines	53,700,000 \$
133.	Madagascar	700,000,000 \$			51,000,000 \$
			182.	Bermuda	51,000,000 \$

183.	Dominica	50,000,000 \$	18.	Malaysia	76,800,000,000 \$
184.	Saint Kitts and Nevis	47,000,000 \$	19.	Austria	74,000,000,000 \$
	Solomon Islands	47,000,000 \$	20.	Sweden	68,600,000,000 \$
186.	Antigua and Barbuda	40,000,000 \$	21.	Australia	68,000,000,000 \$
187.	Sierra Leone	35,000,000 \$	22.	Russia	60,700,000,000 \$
188.	Cape Verde	30,000,000 \$	23.	Thailand	58,100,000,000 \$
189.	Nauru	27,000,000 \$	24.	India	53,800,000,000 \$
190.	Burundi	26,000,000 \$	25.	Turkey	50,800,000,000 \$
191.	British Virgin Islands	25,300,000 \$	26.	Ireland	48,600,000,000 \$
192.	Micronesia, Federated States of	22,000,000 \$	27.	Denmark	47,900,000,000 \$
	Vanuatu	22,000,000 \$	28.	Brazil	46,200,000,000 \$
194.	Eritrea	20,000,000 \$	29.	Poland	43,400,000,000 \$
195.	Palau	18,000,000 \$	30.	Czech Republic	43,200,000,000 \$
196.	Comoros	16,300,000 \$	31.	Saudi Arabia	39,500,000,000 \$
197.	Samoa	15,500,000 \$	32.	Portugal	39,000,000,000 \$
198.	Marshall Islands	9,000,000 \$	33.	Norway	37,300,000,000 \$
199.	Tonga	8,900,000 \$	34.	Hungary	33,900,000,000 \$
200.	East Timor	8,000,000 \$	35.	Philippines	33,500,000,000 \$
201.	Falkland Islands (Islas Malvinas)	7,600,000 \$	36.	Indonesia	32,100,000,000 \$
		6,000,000 \$	37.	Finland	31,800,000,000 \$
202.	Kiribati	6,000,000 \$	38.	Greece	31,400,000,000 \$
203.	Sao Tome and Principe	5,500,000 \$	39.	Israel	30,800,000,000 \$
204.	Anguilla	2,600,000 \$		United Arab Emirates	30,800,000,000 \$
205.	Cayman Islands	1,200,000 \$	41.	Puerto Rico	29,100,000,000 \$
206.	Saint Helena	704,000 \$	42.	South Africa	26,600,000,000 \$
207.	Tuvalu	276,000 \$	43.	Iran	21,800,000,000 \$
208.	Niue	137,200 \$	44.	Venezuela	18,800,000,000 \$
209.	Tokelau	98,000 \$	45.	Ukraine	18,000,000,000 \$
			46.	Vietnam	16,800,000,000 \$
			47.	Romania	16,700,000,000 \$
			48.	Chile	15,600,000,000 \$
			49.	Slovakia	15,400,000,000 \$
			50.	Egypt	15,200,000,000 \$
			51.	Nigeria	13,600,000,000 \$
			52.	Luxembourg	13,250,000,000 \$
			53.	Colombia	12,500,000,000 \$
				New Zealand	12,500,000,000 \$
			55.	Pakistan	11,100,000,000 \$
				Slovenia	11,100,000,000 \$
			57.	Croatia	10,700,000,000 \$
			58.	Algeria	10,600,000,000 \$
			59.	Morocco	10,400,000,000 \$
			60.	Kazakhstan	9,600,000,000 \$
			61.	Argentina	9,000,000,000 \$
			62.	Belarus	8,800,000,000 \$
			63.	Dominican Republic	8,700,000,000 \$
				Tunisia	8,700,000,000 \$
			65.	Bangladesh	8,500,000,000 \$
			66.	Iraq	7,800,000,000 \$
			67.	Kuwait	7,300,000,000 \$
				Peru	7,300,000,000 \$

### Rankings: Imports (All Descending)

Rank	Country	Value / Unit
1.	United States	1,165,000,000,000 \$
2.	Germany	487,300,000,000 \$
3.	United Kingdom	330,100,000,000 \$
4.	France	303,700,000,000 \$
5.	China	295,300,000,000 \$
6.	Japan	292,100,000,000 \$
7.	Italy	238,200,000,000 \$
8.	Canada	229,000,000,000 \$
9.	Hong Kong	208,100,000,000 \$
10.	Netherlands	201,100,000,000 \$
11.	Mexico	168,400,000,000 \$
12.	Spain	156,600,000,000 \$
13.	Belgium	152,000,000,000 \$
14.	Korea, South	148,400,000,000 \$
15.	Singapore	113,000,000,000 \$
	Taiwan	113,000,000,000 \$
17.	Switzerland	94,400,000,000 \$



69.	Bulgaria	6,900,000,000 \$	118.	Ethiopia	1,630,000,000 \$
70.	Lithuania	6,800,000,000 \$	119.	Bolivia	1,600,000,000 \$
71.	Panama	6,700,000,000 \$		Nepal	1,600,000,000 \$
72.	Costa Rica	6,400,000,000 \$	121.	Albania	1,500,000,000 \$
73.	Libya	6,300,000,000 \$		Sudan	1,500,000,000 \$
	Serbia and Montenegro	6,300,000,000 \$	123.	Senegal	1,460,000,000 \$
75.	Ecuador	6,000,000,000 \$	124.	Netherlands Antilles	1,430,000,000 \$
	Lebanon	6,000,000,000 \$	125.	Brunei	1,400,000,000 \$
77.	Guatemala	5,600,000,000 \$	126.	Namibia	1,380,000,000 \$
78.	Oman	5,500,000,000 \$	127.	Korea, North	1,314,000,000 \$
79.	Sri Lanka	5,400,000,000 \$	128.	Afghanistan	1,300,000,000 \$
80.	El Salvador	4,900,000,000 \$	129.	French Polynesia	1,200,000,000 \$
	Syria	4,900,000,000 \$	130.	Mozambique	1,180,000,000 \$
82.	Cuba	4,800,000,000 \$	131.	Haiti	1,140,000,000 \$
83.	Estonia	4,400,000,000 \$		Uganda	1,140,000,000 \$
	Jordan	4,400,000,000 \$	133.	Zambia	1,123,000,000 \$
85.	Bahrain	4,200,000,000 \$	134.	Gabon	1,100,000,000 \$
86.	Angola	4,100,000,000 \$		Papua New Guinea	1,100,000,000 \$
87.	Cyprus	3,900,000,000 \$	136.	Andorra	1,077,000,000 \$
	Latvia	3,900,000,000 \$	137.	New Caledonia	1,000,000,000 \$
	Qatar	3,900,000,000 \$	138.	Armenia	991,000,000 \$
90.	Trinidad and Tobago	3,800,000,000 \$	139.	Barbados	987,000,000 \$
91.	Jamaica	3,100,000,000 \$	140.	Madagascar	985,000,000 \$
92.	Kenya	3,000,000,000 \$	141.	Moldova	980,000,000 \$
93.	Yemen	2,900,000,000 \$	142.	Swaziland	938,000,000 \$
94.	Bosnia and Herzegovina	2,800,000,000 \$	143.	Liechtenstein	917,300,000 \$
	Ghana	2,800,000,000 \$	144.	Congo, Democratic Republic of the	890,000,000 \$
	Malta	2,800,000,000 \$	145.	Tajikistan	830,000,000 \$
97.	Honduras	2,700,000,000 \$	146.	Georgia	750,000,000 \$
98.	Macau	2,530,000,000 \$	147.	Lesotho	738,000,000 \$
99.	Myanmar	2,500,000,000 \$	148.	Congo, Republic of the	730,000,000 \$
	Cote d'Ivoire	2,500,000,000 \$	149.	Bermuda	719,000,000 \$
	Reunion	2,500,000,000 \$	150.	Guinea	670,000,000 \$
	Uzbekistan	2,500,000,000 \$	151.	Mongolia	659,000,000 \$
103.	Paraguay	2,400,000,000 \$	152.	Fiji	642,000,000 \$
104.	Turkmenistan	2,250,000,000 \$	153.	Mali	630,000,000 \$
105.	Aruba	2,210,000,000 \$	154.	French Guiana	625,000,000 \$
106.	Iceland	2,100,000,000 \$	155.	Kyrgyzstan	587,000,000 \$
107.	Botswana	1,900,000,000 \$	156.	Guyana	575,000,000 \$
	Macedonia, FYROM	1,900,000,000 \$	157.	Chad	570,000,000 \$
109.	Uruguay	1,870,000,000 \$	158.	Equatorial Guinea	562,000,000 \$
110.	Bahamas, The	1,860,000,000 \$	159.	Togo	561,000,000 \$
111.	Azerbaijan	1,800,000,000 \$	160.	Laos	555,000,000 \$
	Mauritius	1,800,000,000 \$	161.	Burkina Faso	525,000,000 \$
113.	Zimbabwe	1,739,000,000 \$	162.	Malawi	505,000,000 \$
114.	Cambodia	1,730,000,000 \$	163.	Eritrea	500,000,000 \$
115.	Cameroon	1,700,000,000 \$	164.	Benin	479,000,000 \$
	Nicaragua	1,700,000,000 \$	165.	Cayman Islands	457,400,000 \$
117.	Tanzania	1,670,000,000 \$	166.	American Samoa	452,000,000 \$
			167.	Belize	430,000,000 \$

168.	Greenland	403,000,000 \$	4.	Argentina	155,000,000,000 \$
169.	Maldives	395,000,000 \$	5.	Russia	153,500,000,000 \$
170.	Seychelles	380,000,000 \$	6.	Mexico	150,000,000,000 \$
171.	Niger	368,000,000 \$	7.	China	149,400,000,000 \$
172.	Mauritania	360,000,000 \$	8.	Korea, South	135,200,000,000 \$
173.	Antigua and Barbuda	357,000,000 \$	9.	Indonesia	131,000,000,000 \$
174.	Somalia	343,000,000 \$	10.	Iraq	120,000,000,000 \$
175.	Saint Lucia	319,400,000 \$	11.	Turkey	118,300,000,000 \$
176.	Suriname	300,000,000 \$	12.	India	100,600,000,000 \$
177.	Grenada	270,000,000 \$	13.	Spain	90,000,000,000 \$
178.	Djibouti	255,000,000 \$	14.	Sweden	66,500,000,000 \$
179.	Rwanda	253,000,000 \$	15.	Poland	64,000,000,000 \$
180.	East Timor	237,000,000 \$	16.	Greece	63,400,000,000 \$
181.	Gambia, The	225,000,000 \$	17.	Thailand	62,500,000,000 \$
182.	Cape Verde	220,000,000 \$	18.	Philippines	60,300,000,000 \$
183.	Bhutan	196,000,000 \$	19.	Hong Kong	49,500,000,000 \$
184.	Sierra Leone	190,000,000 \$	20.	Malaysia	47,500,000,000 \$
185.	British Virgin Islands	187,000,000 \$	21.	Israel	42,800,000,000 \$
186.	Saint Vincent and the Grenadines	185,600,000 \$	22.	Chile	40,400,000,000 \$
187.	Liberia	165,000,000 \$	23.	Colombia	38,400,000,000 \$
188.	Saint Kitts and Nevis	152,000,000 \$	24.	Venezuela	38,200,000,000 \$
189.	Micronesia, Federated States of	149,000,000 \$	25.	New Zealand	33,000,000,000 \$
190.	Burundi	135,000,000 \$	26.	Pakistan	32,300,000,000 \$
	Dominica	135,000,000 \$	27.	Hungary	31,500,000,000 \$
192.	Samoa	130,100,000 \$	28.	Egypt	30,500,000,000 \$
193.	Central African Republic	102,000,000 \$	29.	Finland	30,000,000,000 \$
194.	Palau	99,000,000 \$	30.	Nigeria	29,700,000,000 \$
195.	Vanuatu	93,000,000 \$	31.	Peru	29,200,000,000 \$
196.	Solomon Islands	82,000,000 \$	32.	Belgium	28,300,000,000 \$
197.	Anguilla	80,900,000 \$	33.	Saudi Arabia	25,900,000,000 \$
198.	Tonga	70,000,000 \$	34.	South Africa	24,700,000,000 \$
199.	Guinea-Bissau	59,000,000 \$		Taiwan	24,700,000,000 \$
200.	Marshall Islands	54,000,000 \$	36.	Czech Republic	23,800,000,000 \$
201.	Kiribati	44,000,000 \$	37.	Syria	22,000,000,000 \$
202.	Comoros	39,800,000 \$	38.	Denmark	21,700,000,000 \$
203.	Nauru	33,000,000 \$	39.	Algeria	21,600,000,000 \$
204.	Sao Tome and Principe	24,800,000 \$	40.	United Arab Emirates	18,500,000,000 \$
205.	Falkland Islands (Islas Malvinas)	24,700,000 \$	41.	Morocco	17,700,000,000 \$
			42.	Bangladesh	16,500,000,000 \$
				Croatia	16,500,000,000 \$
			44.	Sudan	15,800,000,000 \$
			45.	Qatar	15,400,000,000 \$
			46.	Ecuador	14,400,000,000 \$
			47.	Ukraine	14,200,000,000 \$
			48.	Vietnam	14,100,000,000 \$
			49.	Romania	13,700,000,000 \$
			50.	Tunisia	13,600,000,000 \$
			51.	Portugal	13,100,000,000 \$
			52.	Congo, Democratic Republic of the	12,900,000,000 \$
			53.	Cuba	12,300,000,000 \$

**Rankings: Debt, external**  
(All Descending)

Rank	Country	Value / Unit
1.	United States	862,000,000,000 \$
2.	Brazil	222,400,000,000 \$
3.	Australia	176,800,000,000 \$

54.	Austria	12,100,000,000 \$	105.	Bosnia and Herzegovina	2,800,000,000 \$
55.	Korea, North	12,000,000,000 \$		Papua New Guinea	2,800,000,000 \$
56.	Uruguay	11,800,000,000 \$		Trinidad and Tobago	2,800,000,000 \$
57.	Ireland	11,000,000,000 \$		Uganda	2,800,000,000 \$
58.	Kuwait	10,400,000,000 \$	109.	Iceland	2,600,000,000 \$
59.	Bulgaria	10,300,000,000 \$		Somalia	2,600,000,000 \$
	Cote d'Ivoire	10,300,000,000 \$	111.	Nepal	2,550,000,000 \$
61.	Angola	9,900,000,000 \$	112.	Laos	2,530,000,000 \$
62.	Sri Lanka	9,800,000,000 \$	113.	Mauritania	2,500,000,000 \$
63.	Slovakia	9,600,000,000 \$	114.	Mauritius	2,400,000,000 \$
64.	Lebanon	9,300,000,000 \$		Turkmenistan	2,400,000,000 \$
65.	Serbia and Montenegro	9,200,000,000 \$	116.	Liberia	2,100,000,000 \$
66.	Iran	8,700,000,000 \$	117.	Canada	1,900,000,000 \$
67.	Cameroon	8,600,000,000 \$	118.	Georgia	1,700,000,000 \$
68.	Jordan	8,200,000,000 \$	119.	Benin	1,600,000,000 \$
	Singapore	8,200,000,000 \$		Niger	1,600,000,000 \$
70.	Cyprus	8,000,000,000 \$	121.	Kyrgyzstan	1,500,000,000 \$
71.	Slovenia	7,900,000,000 \$		Sierra Leone	1,500,000,000 \$
72.	Ghana	7,200,000,000 \$	123.	Azerbaijan	1,400,000,000 \$
73.	Panama	7,000,000,000 \$		Togo	1,400,000,000 \$
74.	Tanzania	6,800,000,000 \$	125.	Netherlands Antilles	1,350,000,000 \$
75.	Kazakhstan	6,600,000,000 \$	126.	Burkina Faso	1,300,000,000 \$
76.	Yemen	6,200,000,000 \$		Macedonia, FYROM	1,300,000,000 \$
77.	Myanmar	6,100,000,000 \$		Moldova	1,300,000,000 \$
78.	Bolivia	5,900,000,000 \$		Rwanda	1,300,000,000 \$
79.	Lithuania	5,800,000,000 \$	130.	French Guiana	1,200,000,000 \$
	Nicaragua	5,800,000,000 \$		Guyana	1,200,000,000 \$
	Zambia	5,800,000,000 \$		Haiti	1,200,000,000 \$
82.	Kenya	5,700,000,000 \$	133.	Burundi	1,140,000,000 \$
	Oman	5,700,000,000 \$	134.	Chad	1,100,000,000 \$
84.	El Salvador	5,600,000,000 \$	135.	Tajikistan	1,000,000,000 \$
85.	Honduras	5,400,000,000 \$	136.	Mozambique	966,000,000 \$
86.	Ethiopia	5,300,000,000 \$	137.	Guinea-Bissau	941,500,000 \$
	Jamaica	5,300,000,000 \$	138.	Mongolia	913,000,000 \$
88.	Congo, Republic of the	5,000,000,000 \$	139.	Armenia	905,000,000 \$
89.	Guatemala	4,900,000,000 \$	140.	Central African Republic	881,400,000 \$
90.	Costa Rica	4,800,000,000 \$			
	Dominican Republic	4,800,000,000 \$	141.	Belarus	851,000,000 \$
92.	Madagascar	4,600,000,000 \$	142.	Cambodia	829,000,000 \$
	Uzbekistan	4,600,000,000 \$	143.	Albania	784,000,000 \$
94.	Libya	4,400,000,000 \$	144.	Lesotho	735,000,000 \$
95.	Zimbabwe	3,900,000,000 \$	145.	Barbados	692,000,000 \$
96.	Gabon	3,800,000,000 \$	146.	Namibia	517,000,000 \$
97.	Bahrain	3,700,000,000 \$	147.	Gambia, The	476,000,000 \$
98.	Guinea	3,400,000,000 \$	148.	Belize	475,000,000 \$
	Latvia	3,400,000,000 \$	149.	Bahamas, The	371,600,000 \$
100.	Estonia	3,300,000,000 \$	150.	Djibouti	366,000,000 \$
	Mali	3,300,000,000 \$	151.	Botswana	360,000,000 \$
102.	Paraguay	3,200,000,000 \$	152.	Cape Verde	325,000,000 \$
103.	Senegal	3,100,000,000 \$	153.	Suriname	321,000,000 \$
104.	Malawi	2,900,000,000 \$			

154.	Swaziland	320,000,000 \$	6.	France	34,860,000
155.	Eritrea	311,000,000 \$	7.	Russia	30,000,000
156.	Aruba	285,000,000 \$	8.	India	27,700,000
157.	Maldives	281,000,000 \$	9.	Italy	25,000,000
158.	Macau	255,000,000 \$	10.	Korea, South	24,000,000
159.	Sao Tome and Principe	253,800,000 \$	11.	Canada	20,802,900
160.	Equatorial Guinea	248,000,000 \$	12.	Turkey	19,500,000
161.	Bhutan	245,000,000 \$	13.	Spain	17,336,000
162.	Comoros	232,000,000 \$	14.	Brazil	17,039,000
163.	Antigua and Barbuda	231,000,000 \$	15.	Taiwan	12,490,000
164.	Saint Lucia	214,000,000 \$	16.	Mexico	12,332,000
165.	Samoa	197,000,000 \$	17.	Australia	10,050,000
166.	Grenada	196,000,000 \$	18.	Ukraine	9,450,000
167.	Saint Kitts and Nevis	171,000,000 \$	19.	Netherlands	9,132,400
168.	Seychelles	170,000,000 \$	20.	Poland	8,070,000
169.	Saint Vincent and the Grenadines	167,200,000 \$	21.	Argentina	7,500,000
170.	Dominica	161,500,000 \$	22.	Philippines	6,980,000
171.	Bermuda	145,000,000 \$	23.	Iran	6,313,000
172.	Solomon Islands	137,000,000 \$	24.	Sweden	6,017,000
173.	Fiji	135,900,000 \$	25.	Thailand	5,600,000
174.	Malta	130,000,000 \$	26.	Indonesia	5,588,310
175.	Marshall Islands	86,500,000 \$	27.	Colombia	5,433,565
176.	New Caledonia	79,000,000 \$	28.	Greece	5,431,000
177.	Cayman Islands	70,000,000 \$	29.	Portugal	5,300,000
178.	Vanuatu	68,600,000 \$	30.	South Africa	5,000,000
179.	Tonga	57,500,000 \$	31.	Switzerland	4,820,000
180.	Micronesia, Federated States of	53,100,000 \$	32.	Denmark	4,785,000
181.	British Virgin Islands	36,100,000 \$	33.	Belgium	4,769,000
182.	Nauru	33,300,000 \$	34.	Malaysia	4,600,000
183.	Greenland	25,000,000 \$	35.	Austria	4,000,000
184.	Kiribati	10,000,000 \$	36.	Egypt	3,971,500
185.	Anguilla	8,800,000 \$	37.	Saudi Arabia	3,900,000
186.	Niue	418,000 \$	38.	Czech Republic	3,869,000
187.	Brunei	0 \$	39.	Hong Kong	3,839,000
	Liechtenstein	0 \$	40.	Romania	3,777,000
	Norway	0 \$	41.	Bulgaria	3,186,731
	Palau	0 \$	42.	Hungary	3,095,000
	Tokelau	0 \$	43.	Pakistan	2,861,000
			44.	Finland	2,847,900
			45.	Israel	2,800,000
			46.	Norway	2,735,000
			47.	Chile	2,603,000
			48.	Venezuela	2,600,000
				Vietnam	2,600,000
			50.	Belarus	2,313,000
			51.	Algeria	2,300,000
			52.	Serbia and Montenegro	2,017,000
			53.	Uzbekistan	1,980,000
			54.	Singapore	1,950,000
			55.	Slovakia	1,934,558
			56.	Kazakhstan	1,920,000

**Rankings: Telephones, main lines in use  
(All Descending)**

Rank	Country	Value / Unit
1.	United States	194,000,000
2.	China	135,000,000
3.	Japan	60,381,000
4.	Germany	50,900,000
5.	United Kingdom	34,878,000



	New Zealand	1,920,000	108.	Trinidad and Tobago	252,000
58.	Peru	1,800,000	109.	Myanmar	250,000
59.	Croatia	1,721,139	110.	Ghana	240,000
60.	Ireland	1,600,000	111.	Nepal	236,816
61.	Morocco	1,391,000	112.	Senegal	234,916
62.	Puerto Rico	1,322,000	113.	Honduras	234,000
63.	Syria	1,313,000	114.	Ethiopia	231,900
64.	Lithuania	1,142,000	115.	Zimbabwe	212,000
65.	Ecuador	1,115,272	116.	Oman	201,000
66.	Korea, North	1,100,000	117.	Iceland	196,984
67.	Uruguay	929,141	118.	Malta	187,000
68.	United Arab Emirates	915,223	119.	Macau	176,902
69.	Azerbaijan	865,000	120.	Bahrain	152,000
70.	Latvia	734,693	121.	Qatar	142,000
71.	Slovenia	722,000	122.	Nicaragua	140,000
72.	Dominican Republic	709,000	123.	Botswana	131,000
73.	Lebanon	700,000	124.	Zambia	130,000
74.	Iraq	675,000	125.	Tanzania	127,000
75.	Guatemala	665,061	126.	Albania	120,000
76.	Tunisia	654,000	127.	Namibia	110,200
77.	Moldova	627,000	128.	Barbados	108,000
78.	Georgia	620,000	129.	Mongolia	104,100
79.	Armenia	600,000	130.	Bahamas, The	96,000
	Rwanda	600,000	131.	Cameroon	95,000
81.	Estonia	501,691	132.	Mozambique	90,000
82.	Bangladesh	500,000	133.	Fiji	80,901
	Libya	500,000	134.	Brunei	79,000
	Nigeria	500,000	135.	Netherlands Antilles	76,000
85.	Sri Lanka	494,509	136.	Angola	72,000
86.	Cuba	473,031	137.	Guyana	70,000
87.	Costa Rica	450,000	138.	Virgin Islands	65,000
88.	Kuwait	412,000	139.	Suriname	64,000
89.	Macedonia, FYROM	408,000	140.	Papua New Guinea	61,152
90.	Cyprus	405,000	141.	Cape Verde	60,935
91.	Jordan	403,000	142.	Haiti	60,000
92.	Sudan	400,000	143.	Madagascar	55,000
93.	Panama	396,000	144.	Burkina Faso	53,200
94.	El Salvador	380,000	145.	Bermuda	52,000
95.	Tajikistan	363,000		French Polynesia	52,000
	Turkmenistan	363,000	147.	Benin	51,000
97.	Jamaica	353,000	148.	Uganda	50,074
98.	Kyrgyzstan	351,000	149.	French Guiana	47,000
99.	Bolivia	327,600		New Caledonia	47,000
100.	Luxembourg	314,700	151.	Malawi	45,000
101.	Kenya	310,000		Mali	45,000
102.	Bosnia and Herzegovina	303,000	153.	Gabon	39,000
103.	Yemen	291,359	154.	Swaziland	38,500
104.	Paraguay	290,475	155.	Guinea	37,000
105.	Mauritius	280,900		Saint Lucia	37,000
106.	Reunion	268,500	157.	Aruba	33,000
107.	Cote d'Ivoire	263,700	158.	Andorra	32,946

## 1100 Appendix A: World Rankings

159.	Gambia, The	31,900	3.	Japan	63,880,000
160.	Monaco	31,027	4.	Germany	55,300,000
161.	Belize	31,000	5.	United Kingdom	43,500,000
162.	Eritrea	30,000	6.	Korea, South	28,000,000
163.	Afghanistan	29,000	7.	Italy	20,500,000
164.	Antigua and Barbuda	28,000	8.	Russia	19,000,000
165.	Grenada	27,000	9.	Turkey	17,100,000
166.	Mauritania	26,500	10.	Taiwan	16,000,000
167.	Greenland	25,617	11.	Poland	13,000,000
168.	Laos	25,000	12.	Philippines	11,350,000
	Sierra Leone	25,000	13.	France	11,078,000
	Togo	25,000	14.	Canada	8,751,300
171.	Lesotho	22,200	15.	Australia	8,600,000
172.	Congo, Republic of the	22,000	16.	Spain	8,394,000
173.	Cambodia	21,800	17.	South Africa	7,060,000
174.	Maldives	21,000	18.	Austria	6,000,000
175.	Saint Vincent and the Grenadines	20,500	19.	Malaysia	5,000,000
	Liechtenstein	20,072	20.	Brazil	4,400,000
177.	Congo, Democratic Republic of the	20,000	21.	Czech Republic	4,346,000
	Niger	20,000	22.	Netherlands	4,081,891
179.	Seychelles	19,635	23.	Sweden	3,835,000
180.	Cayman Islands	19,000	24.	Finland	3,728,600
	Dominica	19,000	25.	Hong Kong	3,700,000
182.	Burundi	18,000	26.	Thailand	3,100,000
	San Marino	18,000	27.	Portugal	3,074,194
184.	Saint Kitts and Nevis	17,000	28.	Argentina	3,000,000
185.	Somalia	15,000		Ireland	3,000,000
186.	American Samoa	13,000	30.	India	2,930,000
187.	Micronesia, Federated States of	11,000	31.	Saudi Arabia	2,900,000
	British Virgin Islands	10,000	32.	Singapore	2,740,000
	Djibouti	10,000	33.	Israel	2,500,000
	Guinea-Bissau	10,000	34.	New Zealand	2,200,000
191.	Chad	9,700	35.	Norway	2,080,408
192.	Central African Republic	9,500	36.	Mexico	2,020,000
193.	Samoa	8,183	37.	Venezuela	2,000,000
194.	Solomon Islands	8,000	38.	Switzerland	1,967,000
	Tonga	8,000	39.	Colombia	1,800,229
196.	Comoros	7,000	40.	Denmark	1,444,016
197.	Liberia	6,700	41.	Croatia	1,300,000
	Palau	6,700	42.	Hungary	1,269,000
199.	Bhutan	6,000	43.	Indonesia	1,070,000
	Equatorial Guinea	6,000	44.	Bulgaria	1,054,000
			45.	Slovenia	1,000,000
				United Arab Emirates	1,000,000
			47.	Belgium	974,494
			48.	Chile	944,225
			49.	Greece	937,700
			50.	Azerbaijan	800,000
			51.	Slovakia	736,662
			52.	Vietnam	730,155
			53.	Estonia	711,000

### Rankings: Telephones, mobile cellular

(All Descending)

Rank	Country	Value / Unit
1.	United States	69,209,000
2.	China	65,000,000

54.	Guatemala	663,296	105.	Benin	55,500
55.	Romania	645,500	106.	Jamaica	54,640
56.	Lebanon	580,000	107.	Armenia	50,000
57.	Kenya	540,000		Tunisia	50,000
58.	Paraguay	510,000	109.	Malawi	49,000
59.	Peru	504,995	110.	Swaziland	45,000
60.	Lithuania	500,000	111.	Brunei	43,524
61.	Cote d'Ivoire	450,000	112.	Qatar	43,476
62.	Latvia	401,263	113.	El Salvador	40,163
63.	Kazakhstan	400,000	114.	Mali	40,000
64.	Ecuador	384,000	115.	Mauritania	35,000
65.	Egypt	380,000	116.	Algeria	33,500
66.	Senegal	373,965	117.	Yemen	32,042
67.	Uruguay	350,000	118.	Burundi	30,000
68.	Cameroon	300,000		Sierra Leone	30,000
69.	Mozambique	287,000		Tanzania	30,000
70.	Bangladesh	283,000	121.	Cape Verde	28,119
71.	Botswana	270,000	122.	Angola	25,800
72.	Iran	265,000	123.	Burkina Faso	25,200
73.	Albania	250,000	124.	Lesotho	21,600
74.	Iceland	248,131	125.	Guinea	21,567
75.	Ukraine	236,000	126.	Libya	20,000
76.	Sri Lanka	228,604		Sudan	20,000
77.	Luxembourg	215,741	128.	Ethiopia	17,800
78.	Kuwait	210,000	129.	Malta	17,691
79.	Nigeria	200,000	130.	Trinidad and Tobago	17,411
80.	Reunion	197,000	131.	Panama	17,000
81.	Georgia	185,500	132.	Seychelles	16,316
82.	Haiti	180,000	133.	Congo, Democratic Republic of the	15,000
	Mauritius	180,000			
84.	Puerto Rico	169,265	134.	Honduras	14,427
85.	Macau	158,251	135.	Andorra	14,117
86.	Pakistan	158,000	136.	Netherlands Antilles	13,977
87.	Ghana	150,000	137.	New Caledonia	13,040
88.	Costa Rica	143,000	138.	Greenland	12,676
89.	Dominican Republic	130,149	139.	Macedonia, FYROM	12,362
90.	Uzbekistan	130,000	140.	Jordan	11,500
91.	Gabon	120,000	141.	Bosnia and Herzegovina	9,000
92.	Morocco	116,645		Uganda	9,000
93.	Bolivia	116,000	143.	Burma	8,492
94.	Zimbabwe	111,000	144.	Belarus	8,167
95.	Mongolia	110,000	145.	Barbados	8,013
96.	Zambia	90,000	146.	Bermuda	7,980
97.	Serbia and Montenegro	87,000	147.	Nicaragua	7,911
98.	Namibia	82,000	148.	Sao Tome and Principe	6,942
99.	Rwanda	81,000	149.	Niger	6,700
100.	Cambodia	80,000	150.	Bahamas, The	6,152
101.	Cyprus	68,000	151.	Guyana	6,100
102.	Madagascar	63,100	152.	Gambia, The	5,624
103.	Oman	59,822	153.	Chad	5,500
104.	Bahrain	58,543	154.	French Polynesia	5,427

155.	Fiji	5,200	8.	France	34,800,000
156.	Laos	4,915	9.	United Kingdom	30,500,000
157.	Turkmenistan	4,300	10.	Italy	30,300,000
158.	Suriname	4,090	11.	Mexico	25,600,000
159.	Aruba	3,402	12.	Canada	21,500,000
160.	Congo, Republic of the	3,300	13.	Turkey	20,900,000
161.	Papua New Guinea	3,053	14.	Ukraine	18,050,000
162.	Belize	3,023	15.	Spain	16,200,000
163.	San Marino	3,010	16.	Korea, South	15,900,000
164.	Togo	2,995	17.	Thailand	15,190,000
165.	Cuba	2,994	18.	Indonesia	13,750,000
166.	American Samoa	2,550	19.	Poland	13,050,000
167.	Cayman Islands	2,534	20.	Malaysia	10,800,000
168.	Tajikistan	2,500	21.	Australia	10,150,000
169.	Moldova	2,200	22.	Taiwan	8,800,000
170.	Virgin Islands	2,000	23.	Netherlands	8,100,000
171.	Anguilla	1,629	24.	Argentina	7,950,000
172.	Saint Lucia	1,600	25.	Egypt	7,700,000
173.	Samoa	1,545	26.	Nigeria	6,900,000
174.	Antigua and Barbuda	1,300	27.	Congo, Democratic Republic of the	6,478,000
175.	Maldives	1,290			
176.	Palau	1,000	28.	Uzbekistan	6,400,000
177.	Grenada	976	29.	South Africa	6,000,000
178.	Central African Republic	710	30.	Romania	5,250,000
179.	Solomon Islands	658	31.	Saudi Arabia	5,100,000
180.	Marshall Islands	489	32.	Belgium	4,720,000
181.	Dominica	461	33.	Iran	4,610,000
182.	Nauru	450	34.	Sweden	4,600,000
183.	Vanuatu	310	35.	Colombia	4,590,000
184.	Tonga	302	36.	Hungary	4,420,000
185.	Equatorial Guinea	300	37.	Austria	4,250,000
186.	Saint Kitts and Nevis	205	38.	Venezuela	4,100,000
187.	Guinea-Bissau	0	39.	Kazakhstan	3,880,000
	Liberia	0	40.	Philippines	3,700,000
	Niue	0	41.	Vietnam	3,570,000
	Saint Helena	0	42.	Czech Republic	3,405,834
	Tokelau	0	43.	Bulgaria	3,310,000
	Tuvalu	0		Portugal	3,310,000
	Western Sahara	0		Switzerland	3,310,000
			46.	Finland	3,200,000
			47.	Chile	3,150,000
			48.	Denmark	3,121,000
			49.	Algeria	3,100,000
				Morocco	3,100,000
				Pakistan	3,100,000
			52.	Peru	3,060,000
			53.	Serbia and Montenegro	2,750,000
			54.	Cuba	2,640,000
			55.	Slovakia	2,620,000
			56.	Georgia	2,570,000
			57.	Greece	2,540,000

Rankings: Televisions (All Descending)		
Rank	Country	Value / Unit
1.	China	400,000,000
2.	United States	219,000,000
3.	Japan	86,500,000
4.	India	63,000,000
5.	Russia	60,500,000
6.	Germany	51,400,000
7.	Brazil	36,500,000



58.	Belarus	2,520,000	109.	Senegal	361,000
59.	Ecuador	2,500,000	110.	Madagascar	325,000
60.	Sudan	2,380,000	111.	Burma	320,000
61.	Norway	2,030,000		Nicaragua	320,000
62.	New Zealand	1,926,000	113.	United Arab Emirates	310,000
63.	Ghana	1,900,000	114.	Luxembourg	285,000
64.	Hong Kong	1,840,000	115.	Malta	280,000
65.	Ireland	1,820,000	116.	Zambia	277,000
66.	Iraq	1,750,000	117.	Bahrain	275,000
67.	Lithuania	1,700,000	118.	Mauritius	258,000
68.	Israel	1,690,000	119.	Cyprus	248,000
69.	Oman	1,600,000	120.	Qatar	230,000
70.	Sri Lanka	1,530,000	121.	Kyrgyzstan	210,000
71.	Singapore	1,330,000	122.	Brunei	201,900
72.	Guatemala	1,323,000	123.	Angola	196,000
73.	Moldova	1,260,000	124.	Azerbaijan	170,000
74.	Croatia	1,220,000	125.	Mongolia	168,800
	Latvia	1,220,000	126.	Somalia	135,000
76.	Korea, North	1,200,000	127.	Burkina Faso	131,340
77.	Lebanon	1,180,000	128.	Nepal	130,000
78.	Cote d'Ivoire	1,090,000	129.	Reunion	127,000
79.	Syria	1,050,000	130.	Niger	125,000
80.	Puerto Rico	1,021,000	131.	Tanzania	103,000
81.	Paraguay	990,000	132.	Afghanistan	100,000
82.	Tunisia	920,000	133.	Iceland	98,000
83.	Bolivia	900,000		Mauritania	98,000
84.	Kuwait	875,000	135.	Cambodia	94,000
85.	Armenia	825,000	136.	Fiji	88,110
86.	Tajikistan	820,000	137.	Guinea	85,000
	Turkmenistan	820,000	138.	Barbados	76,000
88.	Uruguay	782,000	139.	Togo	73,000
89.	Bangladesh	770,000	140.	Liberia	70,000
	Dominican Republic	770,000	141.	Netherlands Antilles	69,000
91.	Kenya	730,000	142.	Virgin Islands	68,000
	Libya	730,000	143.	Mozambique	67,600
93.	Slovenia	710,000	144.	Bahamas, The	67,000
94.	Albania	700,000	145.	Benin	66,000
95.	Ethiopia	682,000		Bermuda	66,000
96.	Estonia	605,000	147.	Gabon	63,000
97.	El Salvador	600,000		Suriname	63,000
98.	Honduras	570,000	149.	Namibia	60,000
99.	Costa Rica	525,000	150.	Papua New Guinea	59,841
100.	Macedonia, FYROM	510,000	151.	Sierra Leone	53,000
	Panama	510,000	152.	Laos	52,000
102.	Jordan	500,000		New Caledonia	52,000
	Uganda	500,000	154.	Macau	49,000
104.	Yemen	470,000	155.	Guyana	46,000
105.	Jamaica	460,000	156.	Mali	45,000
106.	Cameroon	450,000	157.	Belize	41,000
107.	Trinidad and Tobago	425,000	158.	French Polynesia	40,000
108.	Zimbabwe	370,000	159.	Haiti	38,000

160.	Congo, Republic of the	33,000	7.	Italy	19,250,000
	Grenada	33,000	8.	Russia	18,000,000
162.	Saint Lucia	32,000	9.	France	16,970,000
163.	Antigua and Barbuda	31,000	10.	Canada	16,840,000
	Botswana	31,000	11.	Brazil	13,980,000
165.	French Guiana	30,000	12.	Taiwan	11,600,000
	Greenland	30,000	13.	Australia	10,630,000
167.	Djibouti	28,000	14.	Netherlands	9,730,000
168.	Andorra	27,000	15.	Spain	7,890,000
169.	Burundi	25,000	16.	India	7,000,000
	Monaco	25,000	17.	Poland	6,400,000
171.	Sao Tome and Principe	23,000	18.	Sweden	6,020,000
	Swaziland	23,000	19.	Malaysia	5,700,000
173.	Aruba	20,000	20.	Philippines	4,500,000
174.	Central African Republic	18,000	21.	Indonesia	4,400,000
	Saint Vincent and the Grenadines	18,000		Portugal	4,400,000
			23.	Hong Kong	4,350,000
176.	Cape Verde	15,000	24.	Argentina	3,880,000
177.	American Samoa	14,000	25.	Switzerland	3,850,000
178.	Liechtenstein	12,000	26.	Belgium	3,760,000
179.	Bhutan	11,000	27.	Austria	3,700,000
	Palau	11,000	28.	Mexico	3,500,000
	Seychelles	11,000	29.	Denmark	3,370,000
182.	Chad	10,000	30.	Chile	3,100,000
	Maldives	10,000	31.	South Africa	3,068,000
	Saint Kitts and Nevis	10,000	32.	Peru	3,000,000
185.	San Marino	9,000	33.	Czech Republic	2,690,000
186.	Samoa	8,634		Finland	2,690,000
187.	Cayman Islands	7,000	35.	Norway	2,680,000
188.	Dominica	6,000	36.	Turkey	2,500,000
	Western Sahara	6,000	37.	Singapore	2,310,000
190.	Gambia, The	5,000	38.	New Zealand	2,060,000
191.	British Virgin Islands	4,000	39.	Israel	1,940,000
	Equatorial Guinea	4,000	40.	Saudi Arabia	1,453,000
193.	Solomon Islands	3,000	41.	Greece	1,400,000
194.	Micronesia, Federated States of	2,800	42.	Iran	1,326,000
			43.	Ireland	1,310,000
195.	Vanuatu	2,300	44.	Venezuela	1,300,000
196.	Saint Helena	2,000	45.	Hungary	1,200,000
	Tonga	2,000		Pakistan	1,200,000
				Thailand	1,200,000
			48.	Colombia	1,150,000
			49.	Romania	1,000,000
			50.	United Arab Emirates	900,000
			51.	Ukraine	750,000
			52.	Slovakia	700,000
			53.	Egypt	600,000
				Puerto Rico	600,000
				Slovenia	600,000
			56.	Bulgaria	585,000
			57.	Kenya	500,000

**Rankings: Internet users**  
(All Descending)

Rank	Country	Value / Unit
1.	United States	165,750,000
2.	Japan	56,000,000
3.	China	45,800,000
4.	United Kingdom	34,300,000
5.	Germany	32,100,000
6.	Korea, South	25,600,000

58.	Croatia	480,000	109.	Bosnia and Herzegovina	45,000
59.	Estonia	429,700		Cameroon	45,000
60.	Belarus	422,000		Namibia	45,000
61.	Morocco	400,000		Panama	45,000
	Serbia and Montenegro	400,000	113.	El Salvador	40,000
	Tunisia	400,000		Honduras	40,000
	Uruguay	400,000		Mongolia	40,000
	Vietnam	400,000	116.	Brunei	35,000
66.	Costa Rica	384,000		Madagascar	35,000
67.	Lithuania	341,000		Malawi	35,000
68.	Ecuador	328,000	119.	Botswana	33,000
69.	Latvia	312,000	120.	Armenia	30,000
70.	Lebanon	300,000		Haiti	30,000
	Tanzania	300,000		Mali	30,000
72.	Iceland	220,000	123.	Azerbaijan	25,000
73.	Jordan	212,000		Benin	25,000
74.	Ghana	200,000		Bermuda	25,000
	Guatemala	200,000		Burkina Faso	25,000
	Kuwait	200,000		Georgia	25,000
77.	Dominican Republic	186,000		Zambia	25,000
78.	Algeria	180,000	129.	Andorra	24,500
79.	Mauritius	158,000	130.	Aruba	24,000
80.	Bangladesh	150,000		New Caledonia	24,000
	Cyprus	150,000	132.	Mozambique	22,500
82.	Bahrain	140,200	133.	Ethiopia	20,000
83.	Papua New Guinea	135,000		Greenland	20,000
84.	Sri Lanka	121,500		Libya	20,000
85.	Cuba	120,000		Nicaragua	20,000
	Oman	120,000		Paraguay	20,000
	Trinidad and Tobago	120,000		Rwanda	20,000
88.	Macau	101,000		Sierra Leone	20,000
89.	Jamaica	100,000	140.	Belize	18,000
	Kazakhstan	100,000		Gabon	18,000
	Luxembourg	100,000	142.	Yemen	17,000
	Macedonia, FYROM	100,000	143.	Bahamas, The	16,900
	Nigeria	100,000	144.	French Polynesia	16,000
	Senegal	100,000	145.	Fiji	15,000
	Uzbekistan	100,000		Guinea	15,000
	Zimbabwe	100,000		Moldova	15,000
97.	Guyana	95,000	148.	Suriname	14,500
98.	Bolivia	78,000	149.	Iraq	12,500
99.	Qatar	75,000	150.	Albania	12,000
100.	Cote d'Ivoire	70,000		Cape Verde	12,000
101.	Angola	60,000		Niger	12,000
	Nepal	60,000		Virgin Islands	12,000
	Syria	60,000	154.	Burma	10,000
	Uganda	60,000		Cambodia	10,000
105.	Malta	59,000		Eritrea	10,000
106.	Sudan	56,000		Laos	10,000
107.	Kyrgyzstan	51,600		Reunion	10,000
108.	Togo	50,000	159.	Sao Tome and Principe	9,000

	Seychelles	9,000	12.	Japan	23,168.00 km
161.	Solomon Islands	8,400	13.	Ukraine	22,473.00 km
162.	Mauritania	7,500	14.	South Africa	22,298.00 km
163.	Swaziland	7,000	15.	Mexico	19,510.00 km
164.	Barbados	6,000	16.	Italy	19,493.00 km
	Burundi	6,000	17.	United Kingdom	16,893.00 km
	Congo, Democratic Republic of the	6,000	18.	Spain	14,189.00 km
	Maldives	6,000	19.	Kazakhstan	13,601.00 km
168.	Grenada	5,200	20.	Sweden	11,481.00 km
169.	Antigua and Barbuda	5,000	21.	Romania	11,385.00 km
	Gambia, The	5,000	22.	Czech Republic	9,462.00 km
	Lesotho	5,000	23.	Turkey	8,607.00 km
	Tajikistan	5,000	24.	Pakistan	8,163.00 km
173.	Chad	4,000	25.	Hungary	7,875.00 km
	Guinea-Bissau	4,000	26.	Iran	7,201.00 km
175.	Saint Vincent and the Grenadines	3,500	27.	Chile	6,585.00 km
176.	Djibouti	3,300	28.	Indonesia	6,458.00 km
177.	Saint Lucia	3,000	29.	Austria	6,024.00 km
	Samoa	3,000	30.	Sudan	5,978.00 km
	Vanuatu	3,000	31.	Finland	5,850.00 km
180.	Bhutan	2,500	32.	Belarus	5,523.00 km
	Comoros	2,500	33.	Korea, North	5,214.00 km
182.	Central African Republic	2,000	34.	Egypt	5,105.00 km
	Dominica	2,000	35.	Congo, Democratic Republic of the	4,772.00 km
	French Guiana	2,000	36.	Switzerland	4,511.00 km
	Micronesia, Federated States of	2,000	37.	Bulgaria	4,294.00 km
	Netherlands Antilles	2,000	38.	Norway	4,178.00 km
	Saint Kitts and Nevis	2,000	39.	Thailand	4,071.00 km
	Turkmenistan	2,000	40.	Serbia and Montenegro	4,059.00 km
189.	Kiribati	1,000	41.	Algeria	3,973.00 km
	Tonga	1,000	42.	Burma	3,955.00 km
191.	Anguilla	919	43.	Uzbekistan	3,950.00 km
			44.	New Zealand	3,898.00 km
			45.	Tanzania	3,690.00 km
			46.	Slovakia	3,668.00 km
			47.	Nigeria	3,557.00 km
			48.	Bolivia	3,519.00 km
			49.	Belgium	3,471.00 km
			50.	Cuba	3,442.00 km
			51.	Ireland	3,312.00 km
			52.	Colombia	3,304.00 km
			53.	Denmark	3,164.00 km
			54.	Vietnam	3,142.00 km
			55.	Korea, South	3,125.00 km
			56.	Mozambique	3,123.00 km
			57.	Zimbabwe	3,077.00 km
			58.	Portugal	2,850.00 km
			59.	Netherlands	2,808.00 km
			60.	Kenya	2,778.00 km
			61.	Angola	2,761.00 km

**Rankings: Railways, total**  
(All Descending)

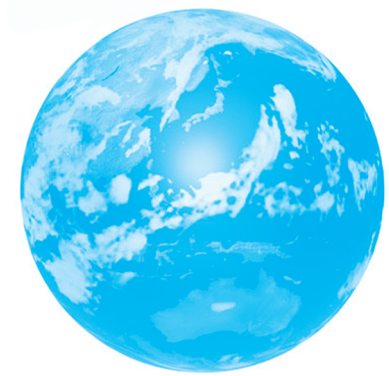
Rank	Country	Value / Unit
1.	United States	194,731.00 km
2.	Russia	87,157.00 km
3.	China	71,600.00 km
4.	India	63,518.00 km
5.	Canada	49,422.00 km
6.	Germany	45,514.00 km
7.	Australia	41,588.00 km
8.	Argentina	34,463.00 km
9.	France	32,682.00 km
10.	Brazil	31,543.00 km
11.	Poland	23,420.00 km



62.	Syria	2,743.00 km			Macedonia, FYROM	699.00 km
63.	Bangladesh	2,706.00 km		105.	Venezuela	682.00 km
64.	Greece	2,571.00 km		106.	Ethiopia	681.00 km
65.	Turkmenistan	2,440.00 km		107.	Cote d'Ivoire	660.00 km
66.	Malaysia	2,418.00 km		108.	Israel	640.00 km
67.	Namibia	2,382.00 km		109.	Burkina Faso	622.00 km
68.	Latvia	2,347.00 km		110.	Cambodia	602.00 km
69.	Croatia	2,296.00 km		111.	Fiji	597.00 km
70.	Zambia	2,173.00 km		112.	Benin	578.00 km
71.	Tunisia	2,152.00 km		113.	Togo	525.00 km
72.	Azerbaijan	2,122.00 km		114.	Jordan	505.00 km
73.	Uruguay	2,073.00 km		115.	Liberia	490.00 km
74.	Lithuania	1,998.00 km		116.	Tajikistan	482.00 km
75.	Iraq	1,963.00 km		117.	Albania	447.00 km
76.	Morocco	1,907.00 km		118.	Paraguay	441.00 km
77.	Peru	1,829.00 km		119.	Kyrgyzstan	420.00 km
78.	Georgia	1,612.00 km		120.	Lebanon	401.00 km
79.	Sri Lanka	1,508.00 km		121.	Panama	355.00 km
80.	Dominican Republic	1,503.00 km		122.	Eritrea	306.00 km
81.	Saudi Arabia	1,392.00 km		123.	Swaziland	301.00 km
82.	Moldova	1,300.00 km		124.	El Salvador	283.00 km
83.	Uganda	1,241.00 km		125.	Luxembourg	274.00 km
84.	Slovenia	1,201.00 km		126.	Jamaica	272.00 km
85.	Guinea	1,115.00 km		127.	Guyana	187.00 km
86.	Taiwan	1,108.00 km		128.	Suriname	166.00 km
87.	Bosnia and Herzegovina	1,021.00 km		129.	Djibouti	100.00 km
				130.	Puerto Rico	96.00 km
88.	Cameroon	1,008.00 km		131.	Sierra Leone	84.00 km
89.	Estonia	968.00 km		132.	Antigua and Barbuda	77.00 km
90.	Ecuador	966.00 km		133.	Nepal	59.00 km
91.	Ghana	953.00 km		134.	Saint Kitts and Nevis	50.00 km
92.	Costa Rica	950.00 km		135.	Haiti	40.00 km
93.	Senegal	906.00 km		136.	Singapore	38.60 km
94.	Philippines	897.00 km		137.	Hong Kong	34.00 km
95.	Congo, Republic of the	894.00 km		138.	Afghanistan	24.60 km
96.	Botswana	888.00 km		139.	Liechtenstein	18.50 km
97.	Guatemala	886.00 km		140.	Brunei	13.00 km
98.	Armenia	852.00 km		141.	Nicaragua	6.00 km
99.	Gabon	814.00 km		142.	Nauru	5.00 km
100.	Malawi	797.00 km				
101.	Madagascar	732.00 km				
102.	Mali	729.00 km				
103.	Honduras	699.00 km				

Compiled by [www.geographyiq.com](http://www.geographyiq.com) from U.S. State Department and *CIA World Factbook* data.





Appendix B: World Atlas

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## World











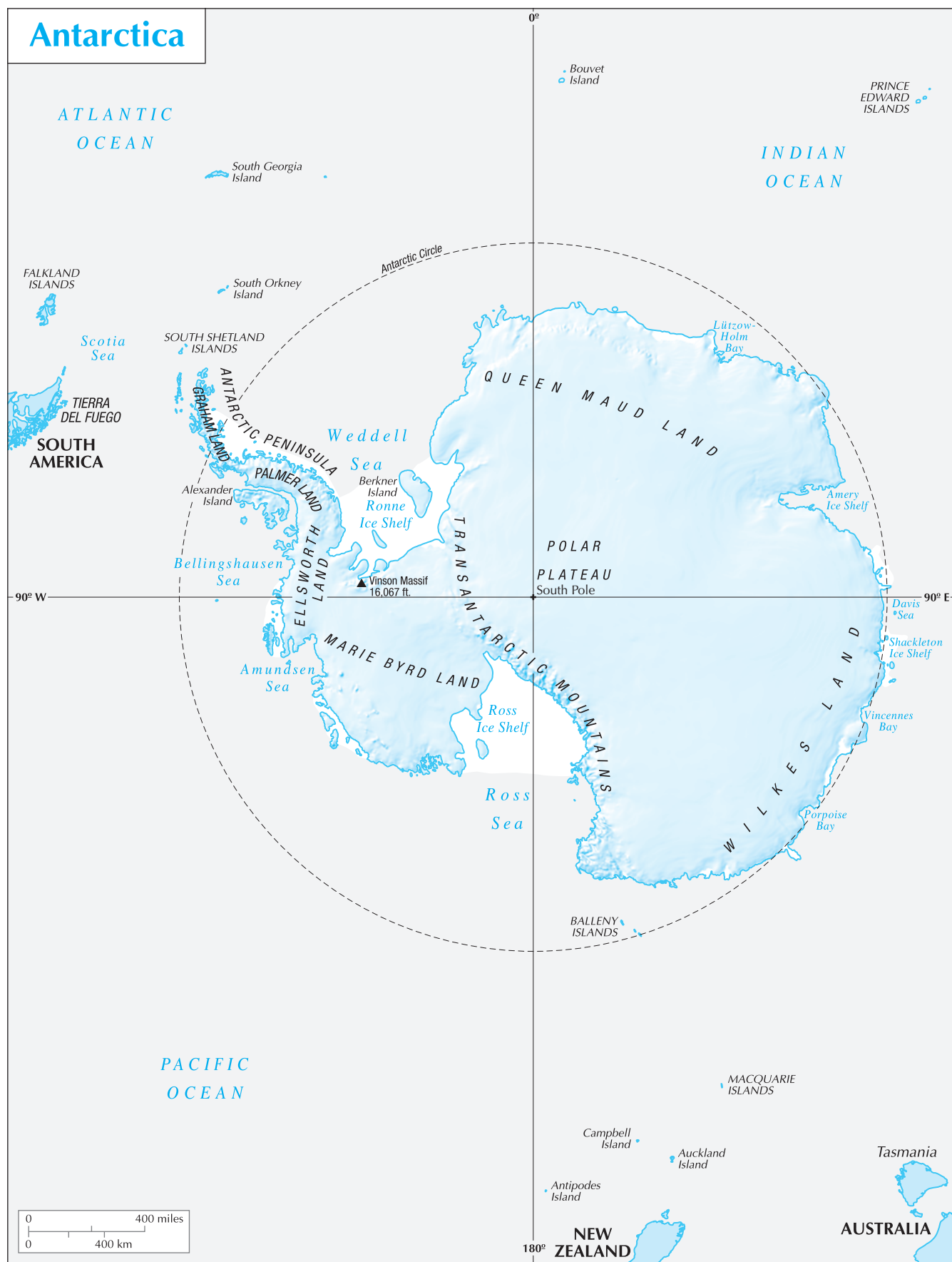










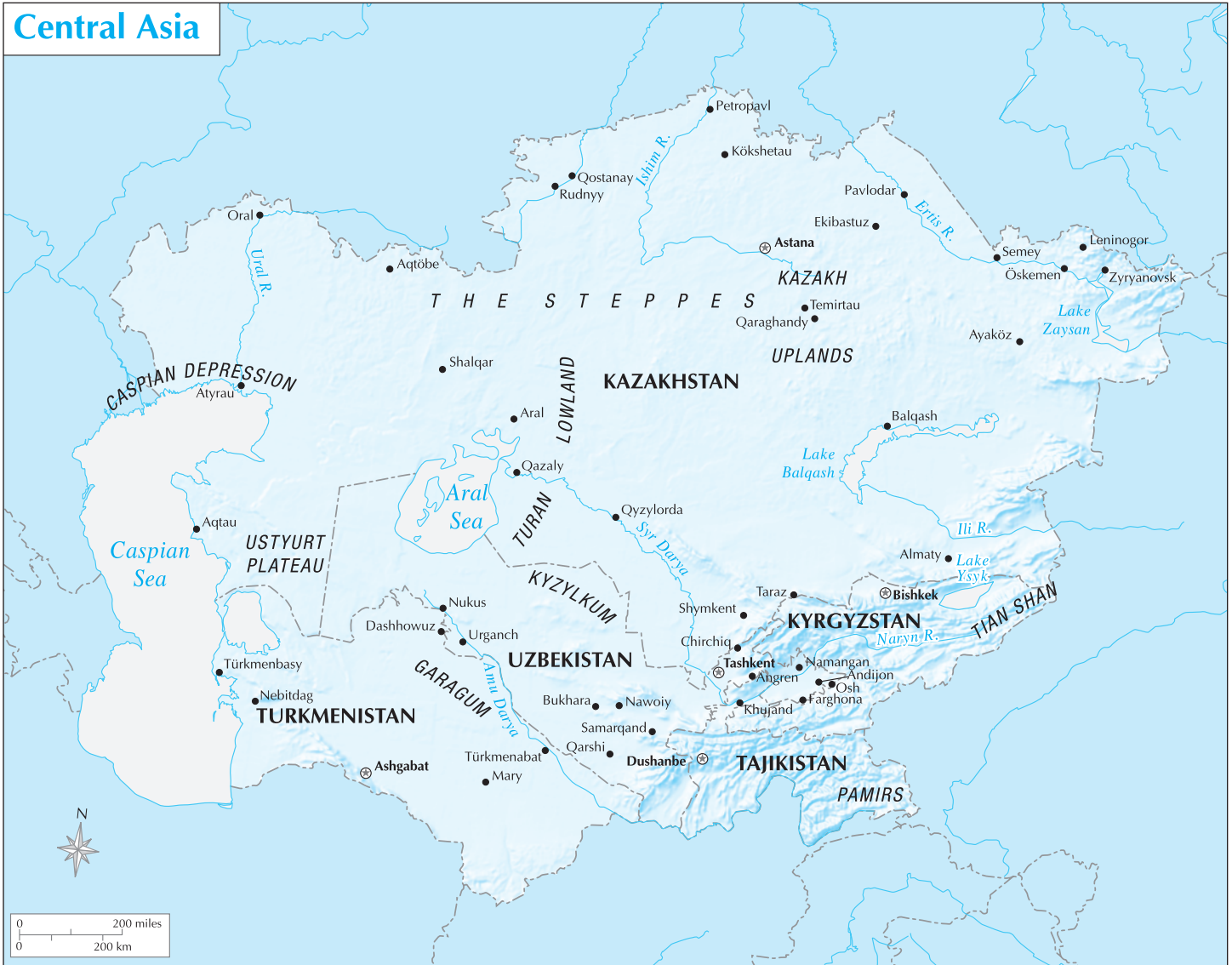


## Asia





## Central Asia











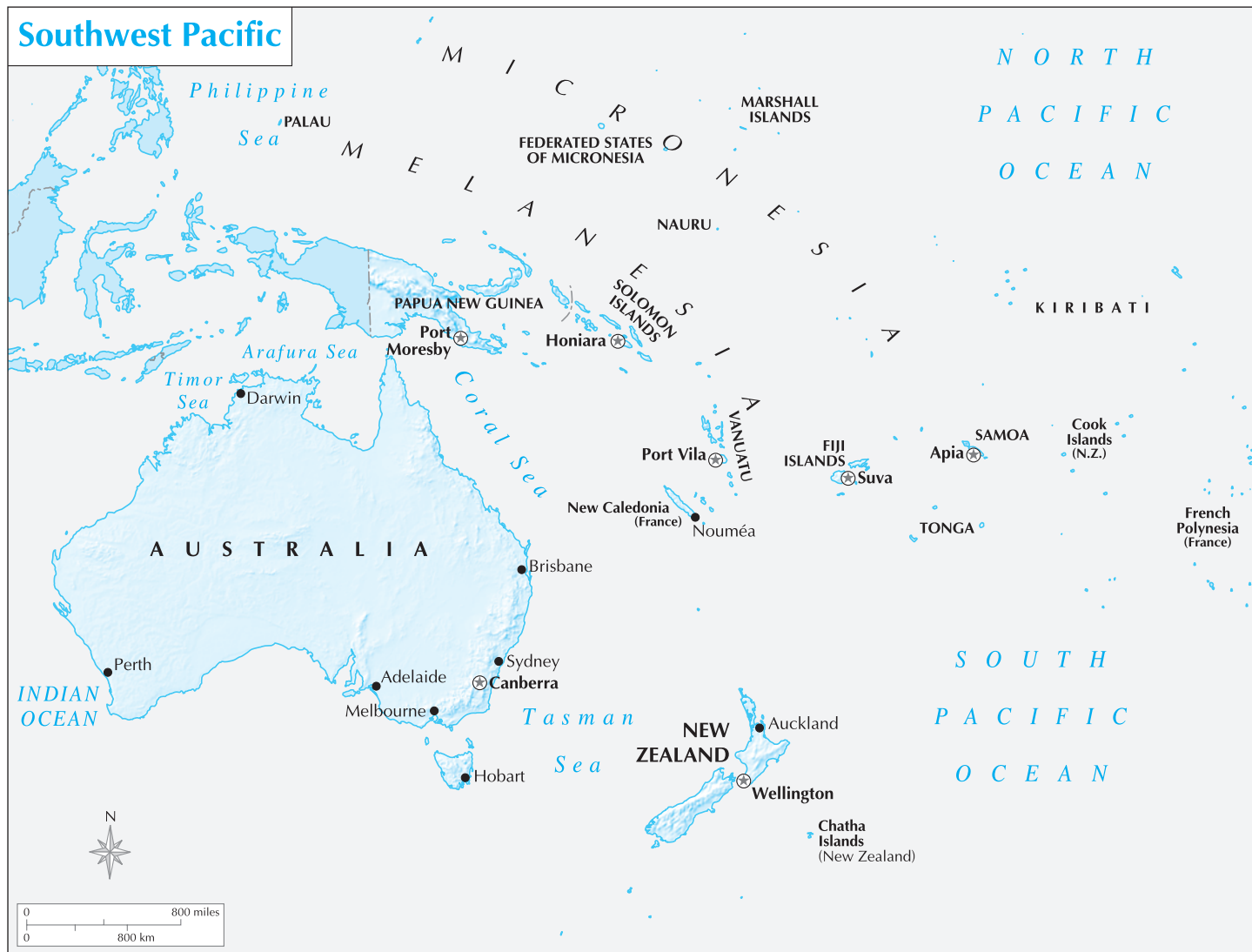


## South Asia





## Southwest Pacific







# New Zealand



## Oceania































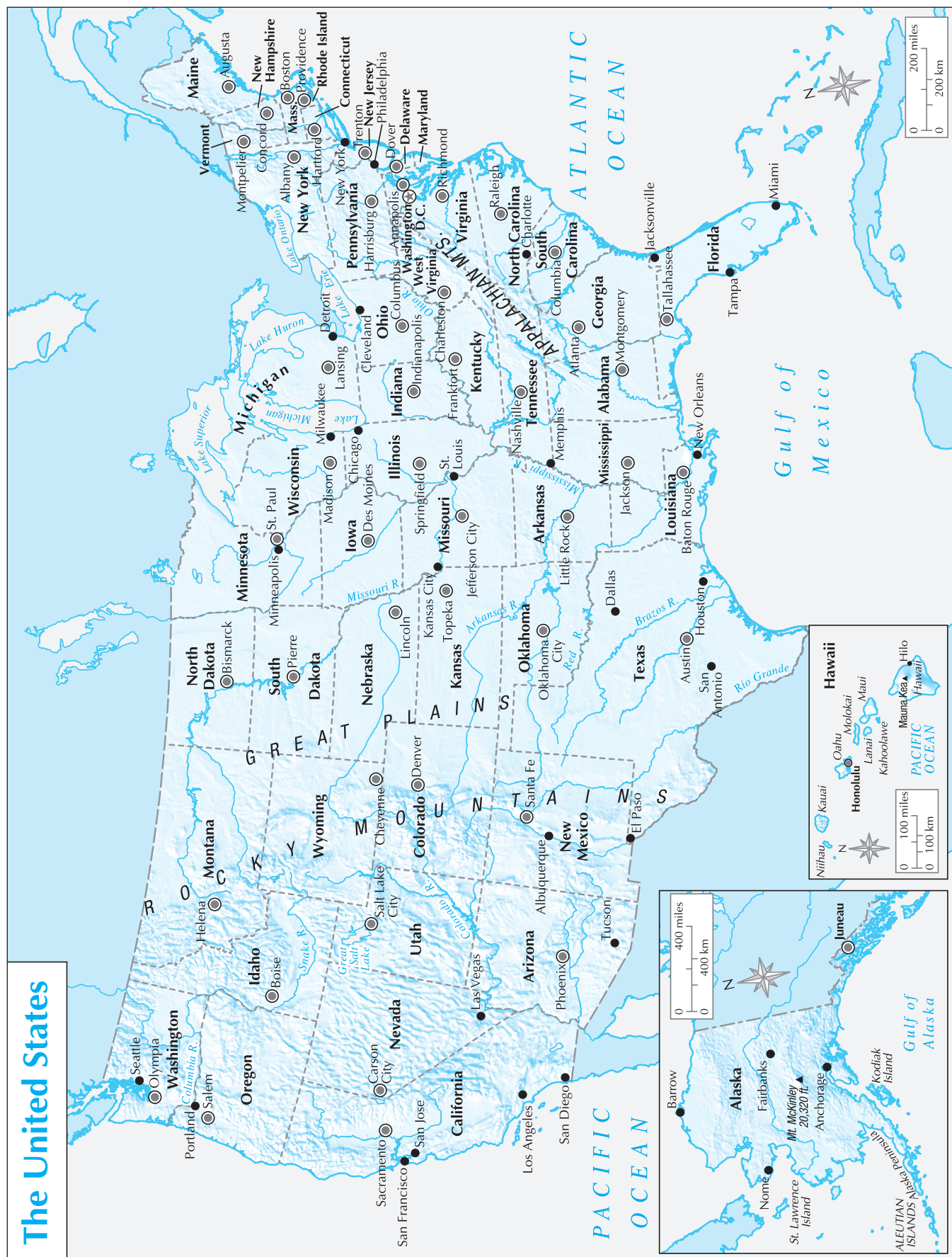


## Northeastern South America

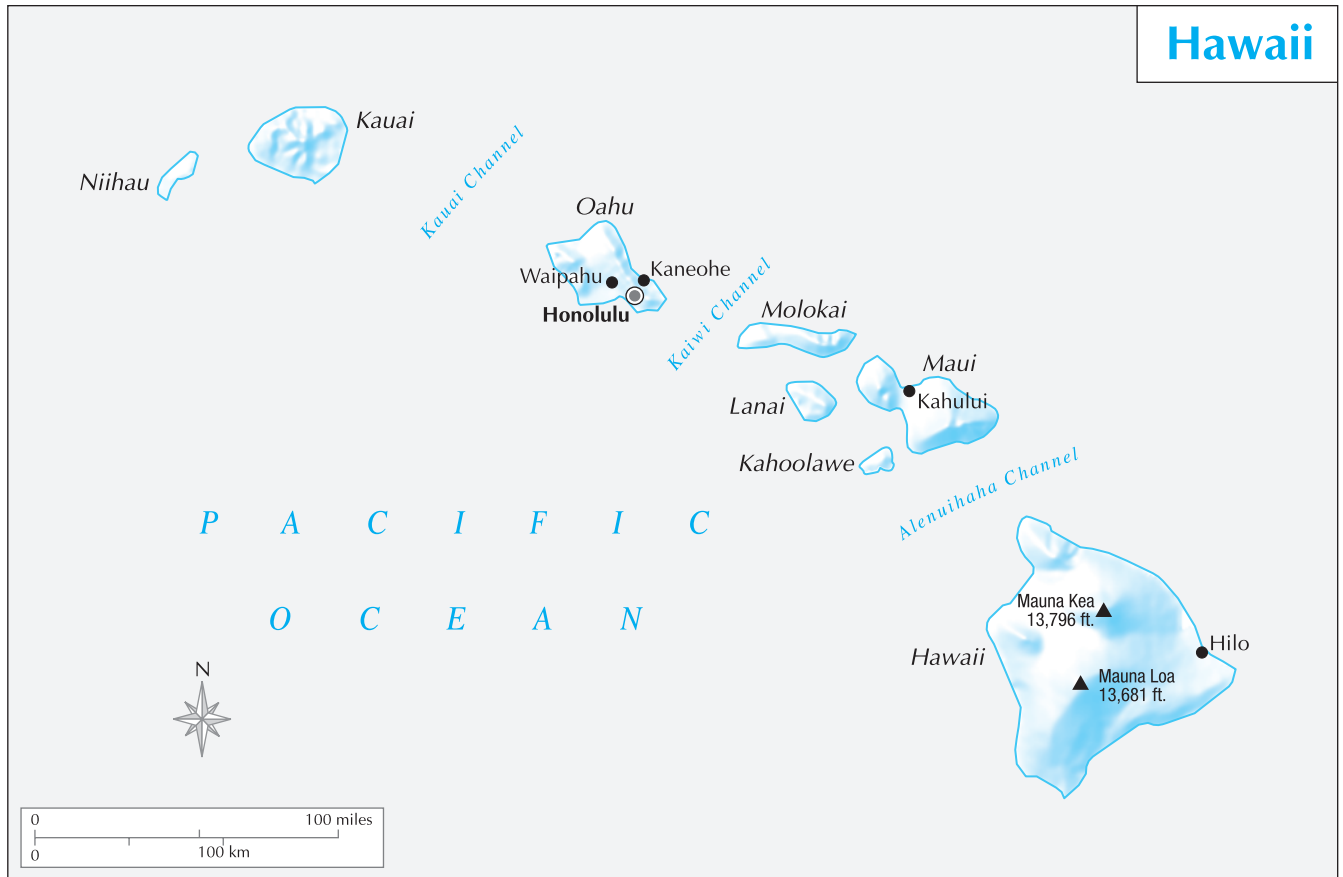












## Western United States

















## Mid-Atlantic United States





## New England United States

